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Mr. Wilson on the Railroads

President Wilson is again in his ideal mood when, in a letter to Secretary McAdoo, he discusses business and the railroads. He has not hesitated on other occasions to speak a word for the distressed railroads. If he appears to have less assurance in his tone this time, it is probably because of uncertainty whether the Interstate Commerce Commission will share his views. After telling how business problems have been met by Congress, he adds: "No doubt, in the light of the new day, with its new understandings, the problems of the railroads will also be met and dealt with in a spirit of candor and justice." The shade of hesitancy in these words is one that is shared generally by thoughtful observers of business and the times. If the Interstate Commerce Commission will do so, it can act as courageously as the President has spoken. He is not afraid of the political results of a reminder to the country, and inferentially to the commission, that the railroads are in need. The Interstate Commerce Commission is presumably a non-political body. A majority of its members were appointed by preceding Presidents, so that it is not answerable, even by courtesy, to the present Executive. It is answerable, however, to the people of the country, and if it does not deal with the grave problem confronting it in a fair spirit the people will hold it responsible for the consequences. No business man of real worth will fail to hope that the President's optimistic remarks regarding recent legislation, and especially the Federal Reserve Bank law, will be borne out by an abundant harvest of prosperity. It must be recognized, however, that that legislation, with whatever it means in good or ill, has been enacted. It is historical. The railroad problem is still before us and growing in seriousness.

The Small Electric Sign

The field of usefulness of the small electric sign grows steadily, and the low cost of operation, the attractive appearance of well-designed equipment of this sort and the unusually effective display secured commend it to the central station seeking to extend its service by small as well as by sizable increments. What the porch lamp has become to the residence street the small electric sign may become in those fields where condensed information, striking directions to those using buildings or narrow thoroughfares, and safety warnings are desirable. Even the bungalow in the suburban district has found the small electric sign bearing the name of the home a useful guide to the visitor at night. For calling attention to the location of physicians' offices, night bells, emergency entrances of hospitals, fire-alarm boxes and countless other conveniences and necessities of civilized life apparatus of this kind has no superior. It is surprising how small a connected load in watts will serve the purpose in such equipment, which, when multiplied throughout extended areas, will furnish a demand upon the central station of the long-hour and highly desirable type. There is an immense field of application here which has barely been entered.

Testing Instrument Transformers

Owing to the high voltages and powerful currents that are commonly met with in alternating-current central-station practice, it becomes frequently necessary to resort to instrument transformers as intermediaries between the system to be explored and the measuring instrument. By this means voltmeters, ammeters and wattmeters not adapted for direct insertion in a tested system may be used advantageously by indirect connection through instrument transformers. It then becomes necessary, however, to know the essential characteristics of the instrument transformers, in order to allow correctly for their effects. Under service conditions instrument transformers in good order exhibit two characteristics essential to their operation, namely, their ratio and their phase angle. The determination of these characteristics is an important task in alternating-current testing laboratories, and various methods are utilized for this purpose. In the article by Dr. P. G. Agnew, on page 1004, there is described a method of testing by employing watt-hour meters. A standard instrument transformer of known characteristics is selected as approximating to the instrument transformer to be tested. The two are then connected to like watt-hour meters, with auxiliary excitation, in such a manner that the registrations of the two meters in a given time permit evaluating the characteristics of the tested transformer in terms of the known characteristics of the standard transformer. It is pointed out in the article that this method is inferior to existing null methods in elegance and precision, but that it can easily be carried out, requires relatively simple apparatus, comparatively little technical skill, and yet is capable of giving satisfactory results in regard to precision. The method is seen to depend on the wattmeter principle, with the power supplied from an auxiliary source, for the purpose of the test. This is one of a variety of ingenious applications of the wattmeter principle to alternating-current measurements, and it deserves to be noticed by testing observers in alternating-current systems.

Photometry of Gas-Filled Lamps

Every photometrist who has tested the gas-filled tungsten lamp has encountered a series of problems of no mean difficulty. The troubles introduced by the new lamp are of three distinct sorts, each in its way exasperating and requiring special study. First of these is the color difficulty which always appears in the photometry of lamps operated at various degrees of efficiency. The color of the light from the gas-filled lamp, while in itself by no means pure white, is much whiter than that of any of the incandescent lamps which preceded it, and hence in comparing it with a carbon-filament standard or an ordinary tungsten substandard there is an outstanding color difference which is somewhat troublesome for the photometrist. We are inclined to think that a sufficient degree of accuracy can usually be obtained by ordinary photometric methods, but for high precision the use of screens as suggested by Dr. Clayton H. Sharp in a paper read before the New York Section of the Illuminating Engineering Society is probably preferable. Of the two possible arrangements, one filtering out some of the red of the ordinary standard and the other reducing the blue component of the gas-filled lamp, we quite agree with Dr. Sharp that the latter is practically preferable.

A second difficulty encountered in dealing with the gas-filled lamp is the great irregularity of the distribution of the light in azimuth owing to the irregular contour of the filament. This difficulty is small in ordinary incandescent lamps and can be overcome readily by rotating the lamp while under test. With the gas-filled lamps the variations are so great that no practicable speed of rotation avoids the difficulty. The scheme used by Dr. E. P. Hyde, of placing behind the lamp two mirrors at an angle of about 120 deg. in order to observe simultaneously the light directly from the lamp in one direction and that from its images in two other directions, reduces this difficulty to a minimum, at the cost of a mirror correction, but with a comparatively low speed of rotation the flicker becomes inconsiderable and another one of the troubles can thus be successfully dodged.

Still a third difficulty comes from the effect of rotation and position on the light of the lamp. The remedy here is to rotate the lamp slowly in the position in which it is to be used. After all this is accomplished there is still trouble in estimating the spherical reduction factor of the lamp, by reason of the effect of small differences in the contour of the filament and the unequal blackening in various portions of the bulb during the life of the lamp. It is somewhat difficult to determine the ratio between the measured horizontal candle-power and the spherical candle-power, which determines the real output of the lamp. For this reason and on account as well of the material difficulties in the ordinary photometry of this source we are very strongly in favor of Dr. Sharp's suggestion that the lamps should be rated on the mean spherical candle-power basis, and preferably in lumens per watt. The mean spherical rating, which can very easily be determined in a sphere photometer, has been recognized for some time as the most logical basis of comparison for lamps giving very different flux distribution. It has in fact repeatedly been recommended and tentatively adopted by various technical bodies, and the only thing which seems to have stood in the way of its introduction is a certain amount of commercial inertia attributable to the fact that most lamps heretofore in use have given their maximum flux near the horizontal. As the older types of lamps are tending to pass out of use and more or less extended surface sources are becoming common, there seems no reason why we should not pass at the earliest possible moment to the proper scientific rating on the basis of lumens rather than candle-power, either apparent or real.

Hydroelectric-Plant Auxiliaries

The year 1914 will be long remembered by those who are operating hydroelectric plants, particularly in the eastern part of the United States, on account of the severe and long-protracted drought. Even in places where there is reasonably good storage the remarkably small flow of the streams has rendered it difficult to maintain full service, and where there is little or no storage steam auxiliaries have been called into requisition to a most unusual extent. In many cases there has been involved long-continued use of uneconomical auxiliaries designed to meet the requirements of brief and occasional use. The returns for the current season will furnish abundant food for reflection for all those interested in hydroelectric affairs. The special bearing of the situation is upon the economics of auxiliary steam plants, which are too often built as cheaply as possible and of size insufficient to take care of the load during a protracted term of scant water. To insure full reliability it is necessary to reckon on a plant large enough to supply economically the hydraulic deficit over a considerably longer period of scarcity than is generally assumed. During this year the low-water period has extended so late into the season as to coincide with the period of rapidly increasing load, and the deficit to be supplied has been enormous.

In designing an auxiliary steam station it is necessary to arrange not only to be able to cope with the longest recorded period of low water but to do so when that period coincides with the time of heavy load. If one examines the hydraulic record of a given stream, he will find a certain average low-water period which may be expected every year during the dry months. He is also likely to find once in a decade a single year, or perhaps two or three, in which the minimum is extraordinarily low, maybe not more than one-half or one-third of the ordinary minimum. A steam auxiliary must take care of this condition whenever it occurs, and to be reasonably sure of safety one should consider the chance of extraordinary drought at an unusual period of the year. In other words, the auxiliary must be planned to cover not only average low-water conditions but the most extraordinary of which the records of runoff or rainfall give any reasonable hint. More-

over, such an auxiliary should be planned to operate economically during the longest low-water period to which any clue can be obtained. All of these conditions point to the wisdom of installing a better plant than is commonly dedicated to such service, both in equipment rating and in operating efficiency. A most valuable body of evidence for future guidance would be formed by records of the experience of those who have suffered during the present season.

The Mayors on Public Utilities

At the conference of American mayors in Philadelphia last week widely varied shades of opinion were expressed on the great public utility issues of the day. The program was made up mainly by and for mayors. The policy of home rule of utilities—that is to say, local instead of state regulation of privately owned plants—proved to be, in at least several cases, only a frankly admitted disguise to cover a real policy of public ownership and operation. However, the fact that various speakers advanced municipal ownership as the remedy for all the ills complained of is not to be taken as the final word of the conference on this important question. The recommendation finally adopted by the conference, that no general conclusion be formulated upon this "abstract question" but that cities should be given the power to municipalize, represents the sober, dominating judgment of the controlling majority. This conclusion binds only those who are in favor of it. The effect, if any, that it will have in the future cannot well be foretold; but it is certainly a distinct departure from the policy of public ownership and operation, regardless of risk, cost or disaster, to which some of the speakers would gladly have committed the entire gathering. What brought about this note of conservatism in the final definite expression of opinion it is not easy to determine. If heeded, the facts given out of the experience of some speakers would exercise a deterring influence. The words of Mr. Erickson about the unsatisfactory municipal operation found in Wisconsin were impressive. The fair address of Mr. Winchester, who has spent his life, absolutely free from political interference, in the management of the South Norwalk municipal plant, is testimony of a kind that nine-tenths of the mayors know they could not get in their own politically ridden cities. Speculate as we may about causes, we cannot doubt that the final adopted conclusion represents firm conviction on the part of the influential mayors that the day of general public ownership is not here, that the day of private ownership with public regulation is here, and that the best use of the cry of public ownership is as a weapon to force companies to give good service and low rates.

On the subject of local versus state regulation the conclusions of the mayors are somewhat non-committal, although tending, as was to have been expected, toward home rule. "No man," said Mr. Guernsey, "should act as a judge in his own case." Yet that is precisely what the mayors who favor home rule want to do. They either do not see the manifest impropriety of deciding their own case or, seeing it, they are determined to do it any way. The demand for home rule is a demand for control. Under this plea the cities, comprising the users of the service, want to say what rates they should pay. This puts the producer wholly at the mercy of the kindly good will of the user. With human nature still frail, with individuals still seeking political advancement and ready to take advantage of a helpless public utility corporation, can anyone doubt that the result of a general policy of this kind would be gross unfairness to many utilities? The old policy of barter for franchises has been succeeded by a better one of rate and service adjustment as the state commissions find conditions justify. The mayors who want both to make the rate and use the rate forget that no successful method has yet been devised of keeping your cake and eating it too.

It is to be noted also that the recommendations declare that municipally owned utilities should be subject to local control only. If the municipally owned utilities are in competition with privately owned utilities and the privately owned utilities are subject to state regulation, what is fair for them is fair for the municipally owned utilities. If it is facts that are wanted, we are of the opinion that, as a rule, they will be brought out more clearly by the elaborate regulative methods of the state commission than by the average municipal system of accounting and report. If the municipal plant is free to discriminate in rate-making, why should the private plant be restricted in that pernicious but business-getting practice?

The constructive work done by the conference, which is intended to yield permanent results, is the approval of the Utilities Bureau as an agency of the cities in the settlement of questions arising with the companies. The position flamboyantly taken by some of the speakers is that this bureau will do for the cities what various associations have done for the companies, that one will be met by the other. Whether this is to be taken as a tribute to or a criticism of the associations is not a serious matter. Just what the mayors mean by a combination of "specialized experts which private interests" "mass in defence of one another" we do not know, but it sounds very formidable and, if true, it is perfectly reasonable that they should oppose to it the "skill, experience and resources of the united cities of the country," assuming, of course, that they do not waste those resources. If when the mayors talk this way they have in mind the associations of public utilities of all kinds throughout the country, they over-color the picture. The proceedings of these associations, as almost any current issues of the *Electrical World* show, are full of papers and discussions that promote good service and efficiency. They are not at all the proceedings of a band of pirates stealthily come together to prey and despoil. In the main the associations are fine instruments of progress. If the Utilities Bureau of the mayors can do as much as the associations have done to upbuild, it will exert a wholesome influence.

The News of the Week

**Activities and Events in the Electrical Field—
Reports of Meetings—Commission Findings, Etc.**

Philadelphia Rate Case

The hearing of the case started by the city of Philadelphia in regard to rates of the Philadelphia Electric Company began before the Public Service Commission of Pennsylvania in Harrisburg on Nov. 17. Among those who testified were Messrs. William Draper Lewis, counsel for Director of Public Safety Cooke of Philadelphia, William Hancock and William H. Ball, chief of the Bureau of City Property, the complainants, and George H. Morse, electrical engineer, of Wheeling, W. Va. On Nov. 18 Mr. Morse and Mr. Judson C. Dickerman, of the Bureau of Gas, of Philadelphia, testified. The hearing will be resumed later.

Meeting of Investment Bankers

The Investment Bankers' Association of America held its third annual meeting at the Bellevue-Stratford Hotel, Philadelphia, on Nov. 12 and 13. Among the reports of committees was one by Mr. John E. Oldham, of Boston, on public service corporations. The list of addresses included "An Equitable Solution of the Public Utility and Conservation Problems," by Mr. Andrew J. Frame, president Waukesha (Wis.) National Bank, and "The Modern Gas Company as a Security for Bonds," by Mr. Rufus C. Dawes, president Metropolitan Gas & Electric Company, Chicago. Mr. A. B. Leach, of A. B. Leach & Company, New York, was elected president for the ensuing year.

Cooper Hewitt Wireless System

Dr. Peter Cooper Hewitt, inventor of the mercury-vapor lamp, rectifier, etc., announces that he has about perfected a variation of the vacuum rectifier which will many times multiply the possibilities of wireless telegraphy and telephony. The receiving apparatus is already completed, and the final touches are now being put on the transmitter. The same receiver is used for both wireless telegraphy and telephony and the inventor prophesies that when the transmitting apparatus is completed it will be possible to telephone directly to Europe. This he attributes to the capability of the instrument to pick up even the faintest current.

Meeting of Electrical Committee of N.F.P.A.

The biennial meeting of the electrical committee of the National Fire Protection Association will be held in New York next March. Suggestions for amendments to the National Electrical Code, in order to be included in the bulletin or suggestion, must be in the hands of the committee not later than Jan. 15. It is recommended that these suggestions be specific and that where a change is desired in a rule or section of a rule definite wording for such change be given, together with the reasons why the change is recommended. As heretofore, the meeting will be open to all interested, and such persons will not only be welcome but are urged to be present and give the committee the advantage of their experience and advice. Mr. Ralph Sweetland, 141 Milk Street, Boston, is secretary of the electrical committee, and to him suggested changes should be addressed.

Cincinnati Decision Favors Competition

Judge Gorman, of the Common Pleas Court of Hamilton County, Ohio, has refused the petition of the city of Cincinnati to prevent the Diamond Light Company from laying its wires under or stringing them over the streets and alleys.

The court held that abutting property owners have the use of the streets for anything they see fit, so long as they do not interfere with them as streets, and may lay wires under them or string wires overhead if they reach an agreement among themselves to do so. Having this right, they may delegate it to others, with the provision that all work done must be according to the requirements made by the city.

It was held further by the court that a monopoly of the business of furnishing energy for light and commercial purposes cannot be given to one individual or corporation and that competition can enforce its rights, notwithstanding the wishes of the city in this respect.

The city wants to make a new contract with the Union Gas & Electric Company at a reduction of rates and sought to protect that company through this suit, in the belief that its rights were being encroached upon.

Program Arranged for Jobbers' Meeting

Elaborate arrangements are being made by the electrical fraternity in Birmingham for the entertainment of the electrical supply jobbers, etc., who will attend the quarterly meeting of the Electrical Supply Jobbers' Association at the Tutwiler Hotel, Dec. 8, 9 and 10. On Dec. 8 there will be the regular registration in the morning followed by meetings of both the central and eastern divisions of the Electrical Supply Jobbers' Association at 11 o'clock. There will be an open-meeting welcome from Mayor George P. Ward of Birmingham at the Tutwiler Hotel at 2 o'clock, followed by a general meeting of the jobbers at 3. For the evening of Dec. 8 a theater party has been arranged for the ladies, and a cabaret and smoker will be tendered by the Newspaper Club on the same night to the men. On Dec. 9 a golf tournament has been arranged at the Roebuck Springs Golf Club in the morning for those not attending the jobbers' meeting, and at 1 o'clock in the afternoon a barbecue will be given, followed by a card party for the ladies at 3. That night there will be a ball and reception tendered by the Birmingham County Club. The following day the ladies will be entertained at a tea at the Southern Club and will pay a visit to the twenty-second floor of the Press Club. Early in the afternoon a ladies' luncheon will be served at the Country Club. The jobbers will hold their regular meeting during the morning, and at 2:30 p. m. Dec. 10 a train will, through the courtesy of the Tennessee Coal,

Iron & Railway Company, leave the Louisville & Northern station for a trip to the iron and steel mills. The work of entertainment is in the active charge of Mr. Oscar Turner, of the Turner Electric Supply Company.

U. S. S. "California" to Be Driven by Motors

The Secretary of the Navy has authorized the installation of a steam-turbine electric propelling plant on the superdreadnaught *California*, which will be built at the Brooklyn Navy Yard. The installation is made on the recommendation of Rear Admiral R. S. Griffin, engineer-in-chief of the navy, and although this type of power plant has already been installed in the naval collier *Jupiter*, the superdreadnaught *California* will be the first electrically driven warship ever built. The decision to install the new system aboard the battleship was decided on after an exhaustive study of the performance of the *Jupiter*, which was the first deep-sea vessel of any type to be fitted with electric motors.

N. E. L. A. Commercial Section Membership

Mr. John F. Learned, Chicago, chairman of the National Electric Light Association's Commercial Section membership committee, has divided the work of this committee into four sections. The divisions together with their officers, are: Eastern section, vice-chairman, Mr. L. D. Gibbs, 39 Boylston Street, Boston; Western section, vice-chairman, Mr. S. V. Walton, 1095 Market Street, San Francisco; West Middle section, vice-chairman, Mr. F. D. Beardslee, Twelfth and Locust Streets, St. Louis; Middle East section, chairman, Mr. John G. Learned, 72 West Adams Street, Chicago.

A chairman has also been appointed for each state. Already the efforts of the committee are beginning to show returns. It is anticipated that there will be a great number of applications for membership in the Commercial Section on or about Jan. 1, 1915, since after that time the Commercial Section membership dues to the amount of $2.50 will be waived.

Pioneer Spirit in Electric-Vehicle Industry

At the monthly meeting of the New York Section of the Electric Vehicle Association of America, Nov. 17, Mr. R. M. Lloyd addressed the assembly on "The Influence of the Pioneer Spirit on Electric-Vehicle Progress." Mr. Lloyd's remarks were chiefly reminiscent and included a recital of his experiences in connection with some of the first American storage-battery companies. The growth of the industry was at first retarded because of expensive litigation and rivalry among the various battery companies. Finally, in 1894, the battery companies merged. About 1895 a number of electric cabs were introduced in New York and they proved very popular. The demand for electric vehicles increased steadily, but unfortunately it was soon realized that many improvements would be necessary before electric cars could successfully compete with other types of vehicles. Mr. Lloyd designated the period from about 1900 to 1908 as the dark age of the electric-vehicle industry. Since 1908 many developments have taken place, and the electric car, Mr. Lloyd asserted, has again come into its own.

In the discussion following Mr. Lloyd's address the various speakers devoted their remarks chiefly to incidents and personal experiences in regard to the first electric cars. Mr. G. H. Duck averred that in some respects the electric-vehicle industry, particularly in reference to salesmanship, is still in the pioneer stage. He declared that the electric vehicle was too often compared with the gasoline car. Each, he stated, has a field of its own. Messrs. D. C. Fenner, F. F. Philips, W. C. Andrews, F. N. Carle, F. B. Neely and W. W. White also spoke.

Work of the Illuminating Engineering Society

At a meeting of the council of the Illuminating Engineering Society held Nov. 12 in the offices of the society, 29 West Thirty-ninth Street, New York, the committee on lighting legislation presented an interesting report on the laws of several states pertaining to lighting. The committee has had collated the laws relating to lighting now on the statute books of the states of New York, Pennsylvania and Connecticut. A model lighting law, however, was thought inpracticable at the present time. Nevertheless, as a step forward toward meeting the situation, it was decided to formulate a "lighting code" on school lighting and another on factory lighting. For more than a year the committee on popular lectures and a number of sub-committees have been gathering data and information which are being put in the form of six popular lectures on lighting. One lecture will deal with the general principles of illumination; the other five will be devoted to the subject of residence, office, industrial, store and school lighting respectively. In all the lectures, which are to be made available for presentation before public and other meetings, the principles of good lighting to be imparted will be reduced to a simple and attractive form.

During the past year the committee on education has undertaken to ascertain the status of illuminating engineering in schools and colleges throughout the country and to foster the establishment of such courses as will ultimately lead to the degree of illuminating engineer.

The committee on progress will prepare a report to be submitted at the next annual convention of the society. The report will review the year's progress in the field of illumination and will be based largely on a summary of the literature published in this country and abroad.

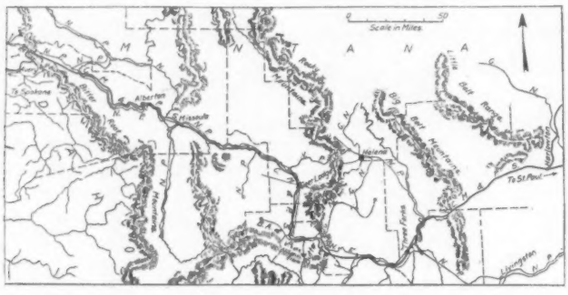
Mr. S. G. Hibben was appointed a director to fill the unexpired term of Mr. F. A. Vaughn, who resigned on account of his election to the vice-presidency. Mr. Alten S. Miller was appointed a director to succeed Mr. V. R. Lansingh. Including these, three changes have been made in the board of directors since the annual election. Mr. C. A. Littlefield resigned as director of the society to become general secretary to succeed Mr. Joseph D. Israel, who was appointed a director to succeed Mr. Littlefield.

Electrification of Milwaukee Railroad

The Chicago, Milwaukee & St. Paul Railway, through Mr. C. A. Goodnow, assistant to the president, has closed a contract with the General Electric Company for the equipment to electrify the first 113-mile section of its main-line Puget Sound division in the Rocky Mountains, between Three Forks and Deer Lodge, Mont. The direct-current system, with a trolley pressure of 3000 volts, will be employed. It is estimated that the labor and equipment for the first 113-mile division will cost about $3,000,000, and that the complete electrification, 440 miles, will cost $12,000,000. Work on the overhead construction is to be started as soon as field crews can be organized. Practically all poles are already on the ground, and the overhead-line material is available for use as needed. The contract calls for delivery of the first

substation equipment on May 1, 1915, and the first locomotive Oct. 1, 1915. The first electrified division will be ready for operation, it is expected, by Jan. 1, 1916.

Hydroelectric energy to operate the electrified road will be supplied under long-term contracts from the systems of the Montana Power Company, Butte, Mont., and the Thompson Falls Power Company, as already



SECTION OF MILWAUKEE RAILROAD TO BE ELECTRIFIED

noted in these columns. For the complete electrification power will be delivered to the railroad system at seven points between Avery and Harlowton. The electrified section crosses three mountain ranges and at the summit of the Rockies reaches an elevation of 6322 ft. above sea level. The highest grade to be ascended is 2 per cent.

GOVERNORS DISCUSS WATER-POWER

Conference of State Executives Urges State Control of Public Lands and Natural Resources and Protests Against Policy of Power Withdrawals

Led by Gov. William Spry of Utah, who read a paper on "State Control of Natural Resources," the Governors' Conference in session at Madison, Wis., on Nov. 11 discussed topics of federal ownership of large tracts of public lands in Western states and the exemption of these lands from furnishing tax revenues to the state governments, the federal leasing of water-powers with right of withdrawal, and the state control of natural resources under conditions of commission regulation similar to those now imposed by utility commissions.

"Conservation" was roundly scored by Governor Spry and other speakers, who declared that the conservation agitation was originated in selfishness by self-appointed guardians of the nation's resources, and that the effect of this policy has been to retard seriously the development of the West. Although the first "conservation congress" of a few years ago was called ostensibly to prevent waste of natural resources, said Governor Spry, it actually developed into a spectacular and wordy exploitation of calamitous and misleading figures and information predicting the early bankruptcy of the nation's natural wealth.

Harm Done by "Conservation"

As a result of the unnecessary alarm thus caused, valuable rights were withdrawn by the government after insufficient field investigation. This has interrupted the development of the West, and at present the cry is even going up for government ownership of all water-powers.

The policy of the federal government in respect to leases and withdrawals is a narrow one, for, though protecting the interests of generations unborn, it omits fulfilment of its obligations to the people who are carrying on pioneer development to-day. The issue raised by federal ownership of land and resources, declared the speaker, is not a political question, for both parties have given the states similar treatment in this direction. But unless a more liberal policy is adopted, predicted Governor Spry, the contention may reach proportions now unguessed and of greater danger to the harmony and union of the states than any influence at present felt. Natural resources form the capital of the states, and the capital of both state and nation is seriously impaired when the use of the states' natural resources is restricted. The matter of who shall control and dispose of natural resources is, however, a minor one compared with the need for at once placing these resources in the hands of those who will develop their usefulness and to the best advantage. The West asks no favoritism or advantage, said the Governor in closing, but it demands equal opportunity with its older sister states in handling the matters of its lands and natural resources.

Private Ownership Preferable from State's Standpoint

In discussing Governor Spry's address, Gov. S. V. Stewart of Montana said that in preference to federal ownership the state should even favor ownership of property by private corporations, for this would at least render the property subject to taxation by the state. Public utilities, he pointed out, are now being regulated by commissions in most of the states, and such a system of regulation applied to natural resources would prevent abuse of monopoly. In this solution of the difficulty by regulation the problem of natural resources, he insisted, seems to have been approached and solved from a new angle. Where the leasing system has been assented to it has been accepted only on the theory that it is better to have water-powers leased and developed than to keep them stored up and useless.

Gov. A. O. Eberhart of Minnesota testified to the difficulty in getting Western representation on the conservation-congress program. The state should undertake no business, he said, which can be transacted efficiently by private interests, and similarly the federal government should exercise no function which can be properly discharged by the state governments. State regulation of public utilities has been found effective, and when all states have such regulation no reason will remain, said Governor Eberhart, why their own resources should not be turned over to the states for proper control and use.

Methods of Government Officials Criticised

Gov. Joseph M. Carey of Wyoming characterized the statutes of the Western States as liberal, but he criticised some of the construction methods employed by the government. Irrigation ditches, for example, he charged, are constructed so expensively by the government engineers that the settlers who gain through the use of the ditches cannot afford to pay the heavy costs involved.

Gov. E. M. Ammons of Colorado said that approximately 5 per cent of the water-power of his state is now developed. He protested against the difficulties which, he said, have been thrown in the way of those who seek to construct storage reservoirs and water-power plants on the upper headwaters of Colorado streams by federal authorities who have declared in explanation that such construction would interfere with the operation of water-power sites lower down. These arguments Governor Ammon characterized as absurd since the power possibilities of any stream would be improved rather than injured by its control to uniform flow. With the aid of state commissions having supervision of water-power subjects, the Governor declared that the greatest use might be made of state water-powers, instead of the least, as at present.

CORONA FROM DIRECT-CURRENT CIRCUITS

Experimental Investigations with Small Wires Subjected to Constant Pressures up to 15,000 Volts—Plotting Motor-Service Curves

Subjects relating to the plotting of speed-time and distance-time curves and corona produced on high-potential direct-current circuits were discussed at the three hundred and first meeting of the American Institute of Electrical Engineers held in New York City, Nov. 13.

Plotting Motor Curves by Graphic Method

Mr. E. C. Woodruff described a very simple method of obtaining speed-time and distance-time curves without employing the usual step-by-step process, which involves tedious calculations. The graphic method, which is a modification of that brought out by Mr. C. O. Mailloux in 1902, consists of plotting "service characteristics" on the same sheet with speed-current and traction-current curves in such a way that time and distance increments can be measured directly with a pair of dividers.

Among those taking part in the discussion of this paper were Messrs. Selby Haar, C. O. Mailloux, M. W. Akimoff, F. Castiglioni, Paul M. Lincoln, N. W. Storer, F. E. Wynne and E. E. Kimball.

Mr. Mailloux declared that the most difficult part of plotting service curves consists of determining the point at which a change in grade or degree of curvature is to be encountered. In his opinion the integraph furnishes the simplest method of plotting such curves. To show the adaptability of this instrument he described its use in practice in detail. He pointed out that the accuracy with which curves can be plotted graphically depends upon the formulas used for train resistance, upon the scale used and the precision of the methods of integration.

A written discussion prepared by Mr. Akimoff was next read in which the author proposed using an archoid to represent the peculiarities of starting motors, locomotives, engines, etc. The proposed curve, while it cannot be employed universally, may be of considerable use in practice in designing and testing machinery.

Mr. Castiglioni described an ingenious practical method of plotting curves which involves the use of speed-distance curves, these being used in determining the proper point at which to cut off the velocity-time curve, and incidentally to determine the distance traversed by the car.

In another written discussion prepared by Mr. Wynne the author expressed the belief that the step-by-step method of calculating and plotting speed-time curves together with the use of a planimeter is more rapid than any graphical method where not more than three curves have to be made for a given weight per motor.

Mr. Kimball gave an illustrated talk in which he showed how closely the ordinary railway motor curve approaches a simple exponential function. He also explained how a slide rule can be used when a motor curve is not available.

In the absence of Mr. Stanley P. Farwell, his paper was presented by Mr. F. W. Peek, Jr.

Corona from Direct-Current Circuits

Experimental investigations with corona around small wires subjected to constant pressures up to 15,000 volts direct current were dealt with in a paper entitled "The Corona Produced by Continuous Potentials," by Mr. Stanley Farwell. The wire and coaxial cylinder method was employed for most of the experiments, but parallel wires were used for a few. Relations were brought out which exist between critical voltage, glow voltage, discharge current, diameter of wire, polarity of conductor, humidity, temperature and atmospheric pressure. Conductors having positive polarity were found to give continuous glow, while negatively charged conductors were surrounded with bead-like corona, the number of beads being a function of the voltage and size of the wire. A short arc in the circuit superimposes a high-frequency current on the direct current. Moisture raised the starting point of the positive corona discharge and acted in the reverse manner for the opposite polarity. Rising temperature had the expected effect of increasing the discharge current. Owing to ionization of the atmosphere at high potentials a conductor carrying a pressure above the critical voltage was observed to raise the air pressure in an inclosing vessel. Corona was also found to be accompanied by mechanical effects, both conductors being deflected in the same direction and subjected to circular vibration.

Discussion

A lengthy discussion ensued in which the following took part: Messrs. L. W. Chubb, A. E. Kennelly, Paul M. Lincoln, Max von Recklinghausen, L. T. Robinson and Selby Haar.

Mr. Chubb called attention to the commercial value that a study of direct current would have on electrical precipitation and the fundamental study of the electron theory and effects of ionization. He also pointed out that the concentration of the direct-current corona into beads or regularly spaced brushes on negative direct-current conductors corresponds with the negative spots in mercury-arc tubes, and that the glow on the positive conductor corresponds in a way with the luminosity around an anode which is being bombarded with electrons.

Mr. Lincoln said that if the energy loss in conductors is a function of the frequency it would appear that there would be no loss at zero frequency, which is not brought out by the tests described in Mr. Farwell's paper.

Mr. von Recklinghausen described luminous effects appearing in mercury-vapor lamps and compared them with the corona discharge from direct-current conductors. Although the loss of energy by corona discharge has limited the voltage of alternating-current circuits to a great extent, the speaker did not believe that this loss would limit the voltage of direct-current transmission as the loss is negligible.

Mr. Robinson expressed the belief that as the critical voltage has a definite value with direct current it can be used for the measurements of high potential.

In closing the discussion, Mr. Peek said that as the starting of corona discharge depends on the maximum voltage, it is evident that a direct-current transmission circuit can be operated at 141 per cent of the voltage of an alternating-current circuit before a corona will appear. One great advantage in favor of direct current, however, is that the insulation will not break down so quickly on a direct-current circuit as on an alternating-current circuit having the same effective voltage. The loss in a direct-current circuit is less than one-quarter of the corresponding loss in a sixty-cycle alternating-current circuit having the same maximum voltage. Attention was called to the fact that if a voltage surge passes through a wire there should be enough time to produce successive collisions, resulting in complete ionization or saturation of the surrounding air. So with transient potential surges there should be considerable corona discharge. If the time required for the surge potential to reach its maximum is about one two-millionth of a second, the starting voltage is approximately double the normal value, but if the time is increased to one two-hundred-thousandth of a second the starting voltage is increased only to the extent of 25 per cent.

PHOTOMETRY OF GAS-FILLED LAMPS

Effect of Lamp Rotation on Candle-Power—Elimination of Flicker—Use of Color-Correcting Filters

Problems in conducting photometric tests on gas-filled lamps and solutions thereof were considered briefly in a paper entitled "The Photometry of Gas-Filled Incandescent Lamps" presented by Dr. Clayton H. Sharp on Nov. 12 before the New York Section of the Illuminating Engineering Society. It was pointed out that an amber color-correction screen placed in front of a high-efficiency lamp during photometric tests has the advantage of reducing by absorption the intensity of the light to be measured instead of that of the standard or weaker source. The disadvantage of using a screen in the position mentioned is that the coefficient of absorption of any selective filter varies with the color of light it transmits. As gas-filled lamps designed for different currents do not emit lights having corresponding spectral values, selective filters used with them cannot be assumed to have constant absorption coefficients. This objection is not encountered when a blue color-correction screen is placed in front of the comparison lamp as the light emitted thereby does not vary in spectral value. The most practical way to calibrate light filters, as suggested in this paper, is to take the average of readings made by a large number of skilled observers under different conditions as to illumination, type of photometers, etc. Dr. Sharp stated that the Bureau of Standards is at present establishing a series of standard filters in conjunction with leading photometric laboratories in this country.

In testing gas-filled lamps there are limitations to the speed at which the lamp can be rotated about its vertical axis to determine the mean horizontal candle-power. When rotated slowly these lamps appear to flicker considerably owing to the arrangement of the filaments, and hence errors in photometric setting become large. By increasing the speed of rotation considerably, however, other difficulties arise. To minimize flicker without introducing other objections the Electrical Testing Laboratories has adopted the expedient of placing behind the lamp two mirrors at an angle of 120 deg. with each other. The photometer screen is set permanently quite far from the mirrors, which are large, and readings are obtained by moving the comparison lamp. With this arrangement the lamp can be rotated slowly without producing flicker.

The speed of rotation also affects the energy consumed and the candle-power of a gas-filled lamp, but the variations do not appear to follow any definite law. With the tip upward during rotation the variations are considerably larger than when the tip is downward. In general, the mean horizontal candle-power is increased, for 400-watt lamps as high as 14 per cent when the speed is increased from 60 r.p.m. to 240 r.p.m. and less for more highly rated units. Lamps should therefore be tested with the tip downward. Multiple lamps give higher mean horizontal candle-power per watt when rotated at high speeds, while series or constant-current lamps show small or negative increase in specific output. The observed variations were attributed to changes in convection, radiation and flux distribution due to the mechanical distortion of the filaments.

Small differences in the arrangement of the filaments affect the spherical reduction factor of gas-filled lamps considerably, and hence the mean horizontal candle-power is an imperfect measure of the total luminous output. The reduction factor is also affected by the deposit of volatilized tungsten on the neck of the lamp during operation, the mean horizontal candle-power decreasing much more slowly than the mean spherical candle-power. Sagging of the filament also causes variations to appear in the spherical reduction factor.

Because of the characteristics mentioned in the foregoing paragraph it was recommended that the specific output of gas-filled lamps be expressed in lumens per watt, with the hope that other classes of illuminants will be similarly rated in the future. In the closing paragraphs of the paper a two-meter integrating sphere which is equipped for the convenient introduction and removal of gas-filled test lamps was described. It was declared that with this apparatus measurements have been taken at the Electrical Testing Laboratories as rapidly and conveniently as with the ordinary bar photometer.

Discussion

Among those taking part in the discussion of Dr. Sharp's paper were Messrs. S. L. E. Rose, Norman Macbeth, W. H. Rolinson, T. H. Amrine, J. B. Taylor, G. M. J. Mackay and Preston S. Millar.

Mr. Rose pointed out that the objection to rating the specific output in flux per watt is that the mean horizontal candle-power cannot be computed accurately therefrom, owing to the gradual change in the reduction factor. Mr. Macbeth called attention to the importance of color value in matching fabrics and said that the flux per watt is a much more desirable value on which to base useful life than the mean horizontal candle-power per watt, which has been used with most illuminants heretofore. Mr. Amrine pointed out that the variations in candle-power of gas-filled lamps at high speeds of rotation are probably due to changes in convection and radiation, since removing the inert gas from the bulbs and producing a vacuum has been shown to reduce these effects considerably. Mr. Mackay said that tilting a gas-filled lamp filament causes it to become hotter and emit more light on one side than on the other, showing that variations due to rotation may also be accounted for by displacement of the filament. Mr. Millar called attention to the fact that gas-filled lamps cannot be constructed as accurately as vacuum lamps and that the distribution of light emitted by similarly rated units may differ considerably. He also pointed out that the useful life of a lamp when based on the mean horizontal candle-power is about twice as long as when based on the total flux.

Color-Correcting Filters

Following the discussion, Dr. Sharp lectured on commercial daylight-lighting equipments and gave data thereon. Booths containing illuminants equipped with color-correcting filters were exhibited to show their relative characteristics in bringing out the colors of similarly dyed ribbons. Among the illuminants displayed were illuminating-gas units, an intensified arc unit, a carbon-dioxide tube and gas-filled lamps. Curves were shown comparing the spectral distribution from these units with blue-sky light. The amount of luminous energy lost in the color filters varies from 64 to 94 per cent.

Mr. Taylor emphasized the need of having the walls, ceiling and woodwork of rooms of the proper color if satisfactory results are to be obtained from daylight-lighting equipments. Mr. Macbeth suggested that the Bureau of Standards adopt a standard light spectrum with which to compare all lights. Mr. Rolinson questioned whether it would not be better to use other than daylight for matching colors, in answer to which Mr. Macbeth said that it is possible to match colors under all lights but they cannot be identified equally well in all. Mr. C. O. Bond suggested that the New York Section of the Illuminating Engineering Society maintain light-comparison booths permanently in which new lighting units can be hung for the inspection of illuminating engineers or other persons interested.

Conference of Mayors on Public Utilities

Meeting in Philadelphia Attended by Executives of Many Leading Cities, Who Listen to Discussion on Local or State Regulation, Public Ownership, Holding Companies and the Public Welfare and Other Issues

The conference of mayors held in Philadelphia last week was attended by the mayors of forty-nine cities. There were also present a number of other officials of cities, representatives of civic clubs and associations, representatives of several of the state public service commissions and members of the Uniform Electric Rate Association.

Starting with a reception at the Bellevue-Stratford Hotel on the evening of Nov. 12, the time of the delegates was kept fully occupied until the end of the concluding session on Nov. 14. On the general reception committee were the names of many prominent Philadelphians, including officials of the local public utility companies. The reception, at which the mayors were welcomed by Ex-Governor Stuart of Pennsylvania and Mayor Blankenburg of Philadelphia, was attended by many men prominent in the banking, civic and industrial life of the city.

In the business sessions, which began on the morning of Nov. 13 and were concluded on the evening of the following day, the formal papers presented were grouped in accordance with subjects prearranged in the program and there was little departure from the arrangement announced in advance. Time was allotted arbitrarily to the different speakers, and there was little opportunity for general discussion. Mayor Blankenburg was the first presiding officer, and when he was called away Dr. Ernest S. Nichols, president of Dartmouth College, presided during the remainder of the first business session. It was at this session that the chairman was directed to appoint a committee on recommendations which did the definite work of the convention. It was at this session also that Mr. Louis D. Brandeis appeared instead of taking part in the discussion of "Holding Companies and the Public Welfare" which was arranged for the evening of Nov. 14. The real subject of the discussion of Mr. Brandeis was the new Utilities Bureau, of which he is one of the trustees. This bureau was proposed at the same time that the movement for the conference was started.

It was at the afternoon session on Nov. 13, devoted to "The Regulation of Utilities," that the discussion began to get warmer in the direction of closer regulation, home rule and public ownership and operation. The tendency in this direction was strengthened by the remarks of Mayor Harrison of Chicago, who presided.

At this session the members of the committee on recommendations were announced by Mayor Blankenburg, as follows: Newton D. Baker, Mayor of Cleveland, chairman; Richard D. O'Brien, Director of Utilities, Seattle; Theodore Theime, Citizens' League of Indiana, Fort Wayne, Ind.; Frederic W. Donnelly, Mayor of Trenton, N. J.; John P. Mitchel, Mayor of New York; Charles E. Merriam, alderman, Chicago; Milo R. Maltbie, Public Service Commission, First District, New York; John M. Eshleman, Railroad Commission of California; H. S. Hocken, Mayor of Toronto; F. C. Thomson, Mayor of Chattanooga.

The proceedings were diverted a little from the main subject of discussion at this session by remarks from Messrs. Percival R. Moses, of New York, and H. W. Ashley, of Toledo, who presented and discussed the point of view of the Uniform Electric Rate Association. Pamphlets issued by this association were distributed.

The evening session on Nov. 13 was held at the Central High School under the auspices of the American Academy of Political and Social Science and was devoted to "Local and State Regulation of Municipal Utilities." The presiding officer was Mayor Mitchel of New York, who was not extreme in his expression of views but presented a policy balanced between state and local control. Of the four speakers, Mr. Erickson, of the Wisconsin commission, stood most strongly for state regulation because the facts brought out by his experience point to the desirability of that policy.

The discussion on "Municipal Ownership and Operation" at the morning session on Nov. 14 was not, as might have been expected, wholly against private ownership and operation. Mayor Baker of Cleveland, and afterward Mayor Curley of Boston, presided at this session.

After the lunch tendered by business men of Philadelphia at the Wanamaker store, brief talks were made at a somewhat informal meeting, over which Mr. Charles A. Prouty, director of the division of valuation of the Interstate Commerce Commission, presided. Among those who spoke briefly were Messrs. M. N. Baker, of the *Engineering News;* Felix Frankfurter, professor of law of Harvard University; F. C. Henderschott, of the New York Edison Company; Mayor Seger of Passaic, N. J., and Mayor Nevin of Easton, Pa. The last-named speaker said that it should not be forgotten that public service corporations made cities what they are to-day. During this meeting Mayor Baker of Cleveland, chairman of the committee on recommendations, presented the report which is published elsewhere in this issue. It was adopted without discussion.

The final session, devoted to "Holding Companies and the Public Welfare," was held at Witherspoon Hall under the auspices of the American Academy of Political Science. It lost some of its impressiveness, so far as the mayors were concerned, by reason of its unfortunate position in the program on Saturday evening at the conclusion of all the proceedings. Secretary of the Interior Lane, who was expected to preside, was not present, and Dr. Carl Kelsey, acting president of the American Academy of Political and Social Science, opened the meeting. A strong presentation of the case of the public utility holding company was made.

According to the list given out, mayors of the following cities were registered: Boston, Philadelphia, New York, Chicago, Cleveland, Sea Isle City, N. J.; Evansville, Ind.; Middletown, N. Y.; Hoboken, N. J.; Kalamazoo, Mich.; Trenton, N. J.; Camden, N. J.; Grand Rapids, Mich.; Rochester, N. Y.; Mount Vernon, N. Y.; Providence, R. I.; Cambridge, Mass.; Perth Amboy, N. J.; Fort Wayne, Ind.; Montclair, N. J.; Ocean City, N. J.; Toronto, Ont.; Wilmington, Del.; Scranton, Pa.; Fall River, Mass.; South Bend, Ind.; Toledo, Ohio; Lebanon, Pa.; Yonkers, N. Y.; Elizabeth, N. J.; Detroit, Mich.; Easton, Pa.; Fort Worth, Tex.; Norfolk, Va.; Akron, Ohio; Allentown, Pa.; Canton, Ohio; Chattanooga, Tenn.; Chester, Pa.; Cincinnati, Ohio; Denver, Col.; Erie, Pa.; Harrisburg, Pa.; Holyoke, Mass.; Minneapolis, Minn.; Newark, N. J.; Passaic, N. J.; Poughkeepsie, N. Y., and Reading, Pa.

Recommendations on Vital Points Formally Adopted by the Mayors

We congratulate the cities and people of America upon the candor and fearlessness with which their representatives have in this conference faced the problem of the relation of the public to public utilities. The conference has been helpful in its interchange of opinion and experience, and especially in its development of the idea of the community of interest among the cities. With that made plain, we can now proceed to a program of inter-city helpfulness which must be the permanent outcome for good from the conference.

We recommend: That no general conclusion be formulated upon the abstract question of municipal ownership, but, rather, we express our judgment to be that municipalities should be given in all instances the power to municipalize public utilities, the expediency of its exercise being at any time and place, and with regard to any particular utility, a matter for local determination.

That we make no general determination as between state board and local or home-rule regulation of public service corporations. That we do, however, declare that the franchise-making power should in all cases be local, that municipally owned utilities should be subject to local control only, that in large cities local regulation is plainly to be preferred, and that in all cases the principles of home rule should be preserved by at least leaving it to the people of a city of whatever size to determine whether they desire to act for themselves or to call in a state board, if one exists, either to regulate or to aid the local authorities in regulating privately owned local utilities.

That we indorse the idea of the establishment of the Utilities Bureau, as a nation-wide inter-city agency for bringing the combined ability and experience of all our cities to the service of each city which may face a public utility problem. Through it we meet the combination of private interests with a combination of public interests, and to the specialized experts which private interests thus mass in defence of one another we oppose the skill, experience and resources of the united cities of the country.

We recommend that the trustees of the Utilities Bureau proceed to its further organization, outlining a plan by which its support may be assured and its services made available. In this connection we suggest for the consideration of the trustees that an office be provided, records kept, experts be employed, and that cities which can legally do so contribute on some equitable basis to the expense of the bureau, in excess of its earning, when in the service of cities actually using its facilities in the solution of particular problems.

We vote our hearty recognition of the high public service performed by Mayor Blankenburg in calling this conference; to Mayors Mitchel, Harrison, Shroyer and Baker, for their sympathetic assistance to him; our appreciation of the gracious hospitality of the city of Philadelphia, and our thanks to the American Academy of Political and Social Science.

Relative Merits of Local Municipal and Broader State Regulation

Mr. Erickson on State Regulation

Mr. Halford Erickson, member of the Railroad Commission of Wisconsin, presented a paper on "State and Local Regulation." He said that if in pointing out a few facts and conditions that may tend to throw light upon the question he should seem to favor state regulation, it is because the facts as he has found them point in this direction.

While state regulation as it is known to-day, said Mr. Erickson, has its shortcomings and often fails to give general satisfaction, it has on the whole been fairly successful. It has led to general improvements in the service and to more equitable and on the whole lower rates. The conditions and tendencies in the public utility field, however, which have brought about state regulation are still present and bid fair to remain so for some time. The public utility field, for instance, is still a legitimate field for private initiative and investments. There is also a marked tendency therein toward centralization in ownership and operation. Electrical and other utilities, while in a sense firmly established, are still subject to upheavals which flow from inventions and from the competition of new sources of supply, and the risks involved therein are considerable.

That the necessity for regulation is not obviated when the utilities are owned and operated by the municipalities is quite clear from such experience as the Wisconsin commission has had in the matter, Mr. Erickson said. Such utilities furnish no better service than privately owned or operated utilities. In fact, it is often a great deal worse. Municipalities are, as a rule, slow in responding to new discoveries and improved methods, and they often fail to list and supervise their meters and other equipment properly. While some municipalities furnish good service, the service in the great proportion of them is, on the whole, on a lower level than is the case for privately operated plants.

When it comes to rates the situation from municipally operated utilities is no better. When the commission first entered upon its duties, it found the State literally streaked with unjust discriminations of all kinds, and these discriminations were as flagrant in municipally operated as in privately operated plants. While the rates charged by the municipally operated plants are often relatively low, this is not often due to low cost production of the service, but largely because in one way or another upkeep and other costs are shifted from the consumer as such to the taxpayer as such.

Replies received to a circular letter sent to all utilities in the State operating electric, gas or water departments indicate that nearly 40 per cent of such departments operate beyond the boundaries of a single city. Replies were received covering 277 such departments, and of these 106 were not confined to a single municipality. Among these 106 were many of the larger utilities. In Wisconsin one power company operates in seven cities and villages and in the intervening towns. Each of three other companies of this kind operates in from three to twelve cities and villages and in the towns through which they pass. One company operates in more than twenty cities and villages as well as in towns between them. In Michigan the Commonwealth Power Company supplies twenty-one cities and villages and the Grand Rapids-Muskegon Power Company supplies fourteen. The Iowa Railway & Light Company supplies gas, electric or electric railway service in forty-eight cities and villages. The Central Illinois Public Service Company has properties in more than 100 cities and villages. Suppose that each of these cities and villages started out to regulate this company or so much of it as was within its limits, 100 different regulative bodies controlling the same corporation or its branches. Local control would be running riot.

Dr. Maltbie on Local or State Control

Dr. Milo R. Maltbie, member of the New York Public Service Commission, First District, in his discussion on "Local and State Regulation of Municipal Utilities" said that every attempt at a practical solution of the problem must recognize certain facts. First, every generation is apt to have its own ideas of the scope and distribution of governmental powers. Second, economic and social conditions are shifting constantly. Third, there has been a steady expansion in the field of operation of a single utility. Fourth, effective regulation of such large utilities is difficult and expensive. Overestimating the importance of these facts, there are those who urge that all control should be transferred from local authorities to the state board; that our great cities, which have a larger population than some states, should be ousted from all supervision over their utilities, and that even the franchise-granting function be taken from them. Between this extreme and complete local regulation there is a middle ground, for certain functions can be exercised more effectively by a state board and others more wisely administered by local authorities. If municipal authorities have been corrupt and if the power to grant or withhold franchises has been abused, the remedy is not state centralization but reform of local conditions, and we have progressed too far in this direction to take a backward step.

Control over the issuance of securities by public service corporations, Dr. Maltbie said, should be lodged in a state authority. As the corporation is chartered by the state and as it must act as a unit, and as securities are issued, not by an entity having a local situs but by one having a state-wide existence, it is obvious that from a logical and from a practical point of view the regulation of securities is a function belonging to a central authority whether exercised by a state legislature or by an administrative board. Supervision of accounts and the filing of reports are also matters which should be under state supervision for similar reasons. While it is not impossible for municipalities to regulate rates and while there have been many instances where this power has been wisely and frequently exercised by municipalities, it will be found increasingly difficult, and if it is not now it soon will be necessary in most instances for the state authorities to control rate regulation. In the meantime and while state commissions are perfecting their methods and organization it is not advisable to deprive every local authority, and particularly the large cities, of all control over rates.

There are extremists, said Dr. Maltbie, who advocate that to state commissions should be given power to determine what rates should be charged by municipalities operating their own utilities and what principles shall be followed in rate-making. This is another radical infringement of the home-rule principle and would virtually prevent a municipality from dealing with its utilities upon a public-health or common-good basis and require it to raise funds as prescribed by a state board.

Dr. Maltbie said that the most practical plan which has occurred to him is for local authorities to continue to exercise the control now vested in them by statutes and city charters but to provide that in case of conflict between different local regulations or between local and state regulations the action of the state regulatory body should be controlling.

Mayor of Reading on Local Regulation

Mayor Ira W. Stratton of Reading, Pa., said that while the aim of commission government is to centralize and to concentrate power and authority the pendulum can be made to swing too far in that direction and the matter be overdone. That has been the case in Pennsylvania. Mayor Stratton said that he had no grievance against the individual members of the commission, their character, integrity and honesty of purpose. He does not believe that the commission would intentionally use the vast power at its command to the detriment of the municipalities of the State, but no necessity exists for conferring it upon them and the act should be modified very materially.

Mayor Mitchel on City Needs

Mayor John Purroy Mitchel of New York spoke of the new Utilities Bureau as a clearing house of information.

The old hostility toward the companies has very largely waned, and this has been helped by the decided change in the managerial policy of the corporations. The companies have sought to give good service rather than otherwise. People are no longer willing to accept poor service. In every great city public opinion expects very high-grade service and clean, efficient and straightforward management. In case such service is not forthcoming the public is prepared to provide it through public ownership. Public ownership is a reserve power of which the companies are conscious.

What the cities want, Mayor Mitchel continued, is a high quality of service at just rates providing a fair return and providing for the upkeep of the property. The public cannot mulct the public service corporation of just profits and expect efficient management. There must be fair wages, good service and wholesome management. After that rate reductions and revenues for the benefit of the city treasury can be considered. Mayor Mitchel said that New York is not advocating a change from private to public ownership, but is advocating the policy of rigorous control of management which it has had for the last seven years. New York has benefited from the work of the Public Service Commission as much indirectly as directly. The presence of the commission and the temper of the public that it represents have brought about a great change in the attitude of public service corporations. The city now looks forward confidently to the time when the subway and elevated lines will revert to it.

"Some of us," said Mayor Mitchel, "have thought that the Public Service Commission has lacked aggressiveness. We do not feel that it is a part of us, that it is in close enough touch with what we are doing. I felt this so much that I organized a department of public utilities in the city's law department which is intended to represent the people of New York City in their regulative cases and hearings before the commission." Mayor Mitchel said that he also had thought of a plan to establish a local commission which should voice the interests of the people in the locality.

Professor Merriam on Local Regulation

Prof. Charles E. Merriam, professor of political science at the University of Chicago, in speaking of the passage of the Illinois Public Utility Commission act by the Legislature of 1913, said that through that act the city of Chicago was made the victim of as daring a raid as was ever made by a pirate crew. The bill was passed, he declared, in the interest of the public service corporations. Cities should possess the power to regulate public service corporations which are largely local. They should be given the option of whether or not they shall retain the control over all utilities operating within their borders. There is nothing to prevent cities from securing the best advice to guide them in their regulation of local utilities. The city of Chicago has ample funds for the proper regulation of public service corporations, and it would be entirely feasible for it to have a staff of experts.

Various Practical Utility Problems Affecting Companies and Consumers

Mr. Guernsey on State Regulation

Mr. Nathaniel T. Guernsey, general counsel of the American Telephone & Telegraph Company, New York, in talking of "Regulation of Municipal Utilities," said that what the public wants and demands is, first, good service; second, the widest possible extension of this service, and, finally, a fair price. From the standpoint of the utility, if it is to fulfil these public requirements, two things are absolutely essential. The first is that there be a return from its operation sufficient to attract constantly the new capital which is continually necessary. To-day and in the near future public utilities, for the money which they require, must compete not only with all normal demands, but with the enormous abnormal requirements due to the war. The second essential is that freedom in the transaction of business which is necessary to progress and to efficient, economical operation, and that this freedom be not unduly restricted by attempts at so-called regulation, which are not in fact regulation, but are efforts to control the details of management and operation.

Regulation, Mr. Guernsey added, costs money. It is not an overstatement to say that millions of dollars are being spent every year for this purpose in the United States. In the ultimate analysis this burden inevitably falls upon the public. It is an item in the cost of the service. To make regulation a benefit to the community and to justify the enormous expense which it imposes upon the public several things are necessary: (1) The regulatory body must be composed of men of unquestioned integrity and force of character. (2) The men composing the regulatory body must have not only the capacity but also the business and special training necessary to the proper determination of the important and intricate questions which are presented to it. (3) The regulatory body should be composed of men who are free from other interests and engagements which would tend to prevent their giving to the performance of their duties the time which is requisite if sound results are to be obtained.

If these general considerations are sound, the conclusion is inevitable that the regulation of municipal utilities should be not local but in the hands of the state commissions. No man may or should sit as a judge in his own case.

The idea seems to be more or less prevalent, Mr. Guernsey added, that the function of regulation is to decrease prices and impose burdens upon the public utilities. Every burden upon a public utility is a burden upon the public, which in the final analysis must pay the bills. If the burden brings with it a benefit that is worth to the public what it pays for it, the public can afford it. Otherwise it cannot. Rates cannot be indefinitely reduced by regulation. The downward tendency in rates that has been constant in recent years has been partially met by economies that have been brought about through efficiency in management and operation; but there is a limit to what may be accomplished by such economies, and if this limit has not already been reached it will be soon. Neither by regulation nor by anything else can the public buy service for less than it is worth. To attempt to do this is to invite bankruptcy. The matter of the regulation of municipal utilities is still in the development stage in this country. If this development is to result in successful regulation, something that will contribute substantially to the welfare of the public as a whole, this must be accomplished through the co-operation of the public and the public utilities with a frank recognition of the principles discussed. It should result in good will, decreased cost and increased efficiency.

Mr. Brandeis on the Utilities Bureau

Mr. Louis D. Brandeis, of Boston, said that in order to ascertain the facts relating to cost of plant and cost of operation it is necessary to have comprehensive and accurate knowledge. For a long time there has been co-operation among the public utility interests through associations which have advanced in great degree the efficiency of operation. The cities, on the other hand, had no plan of co-operation and the proposed Utilities Bureau is not only a plan but an instrument of co-operation.

The objection to stock watering, Mr. Brandeis said, is not at all that men who engage in these enterprises get a large return. Those who in public utility risks hold that a proper return is a fair return compared with other lines of business are right. Risk and ability should receive that return which is a fair reward. It is for the public interest that it should have that return, that interest and ability should be rewarded. The objection is not that men should not obtain a large return—in many instances they have not received such a return—but that stock watering hides the facts as to the investment. Men have resorted to it many times to mislead the public. They have mistrusted the public. They have believed that the public would not regard the actual investment and risk. Mistrust rather than a desire to mislead underlies stock watering.

Mr. Brandeis discussed the protest against interlocking directorates, which he said also tend to obscure facts. If the man that buys money for a public service corporation is a banker himself, the same individual is dealing with himself in two capacities. The public has not the ordinary assurance that the best trade is made. The same man as banker sells money to himself as a public utility corporation manager; then he buys from himself as owner or manufacturer apparatus which is used; then he contracts with himself as a construction company; then he contracts with himself as a supply house; then he may sell to himself as a manufacturer or other concern service which the corporation was organized to give.

No man, said Mr. Brandeis, can serve two masters properly. It is in the interest of truth that we must demand that interlocking directorates and every conflicting interest must vanish. There are other reasons why this practice must be abolished. It is in the interest of efficiency, not only in buying and trading but of efficiency generally. The only justification for the existence of directors is that they shall direct, not manage, but intelligently and absolutely fairly advise and criticise. No man can have the necessary varied knowledge of facts in many enterprises. The New Haven situation was brought about, not by improper motives to any extent in the men who presided over its operations, but mainly through ignorance. There is a limitation placed by nature on the time that can be allotted to any corporation by one individual.

Municipal Lighting Rates

Mr. Ray Palmer, commissioner of gas and electricity, Chicago, Ill., read a paper on "Municipal Lighting Rates." He said that the two principal factors discouraging municipal ownership of public utilities in our cities to-day are bad politics and the relatively high union scales paid municipal labor compared with that of the low scale paid utility corporation labor for the same class of work. When the results of bad politics are eliminated by non-partisanship elections and a fair living scale of wages is established and regulated in all classes of labor the municipality will be placed on the same operating cost basis of utility serv-

ice as the corporations, with the advantage of low interest charges on the investment. Until such time as this is accomplished municipal ownership will seldom be economical or practical for the public taxpayer.

Mr. Palmer then described what has been done in municipal street lighting by the city of Chicago in conjunction with the Sanitary District.

The first and most important step to be taken to utilize properly all the good rate regulation work and improvements which have been accomplished in various cities is that of close co-operation, said Mr. Palmer, between the various cities in conjunction with concerted action for fair and reasonable utility rates such as the conference of mayors contemplates. The second step should be the organization of national committees which will work under the direction of the trustees of the Utilities Bureau.

Transit Problems in Philadelphia

Discussing "Philadelphia's Transit Problem," Mr. A. Merritt Taylor, director of the department of city transit of Philadelphia, described the program providing for the construction of subway and elevated railway lines by the city at a cost of $46,000,000, and the equipment and operation thereof by the company in common with its existing systems.

"We recognize," said Mr. Taylor, "the importance of co-operation between the city and the company in establishing these new facilities in a manner calculated to best serve the public. We also recognize the importance of protecting against destructive competition capital which has been invested in the existing system. Philadelphians stand for a 'square deal' between the city and vested interests. We recognize the vital importance of honestly protecting capital invested in Philadelphia to the extent that it shall produce an attractive return for reasonable service rendered to the public. In the case of our local railway system a contract was entered into in 1907 between the city and the company. With the terms of this contract in force as a basis, it is the policy of the department of city transit in establishing the high-speed lines under the terms of the co-operative program to protect the company to the extent of its annual net earnings gained prior to the operation of the municipally owned lines regardless of the amount of capital actually invested in the property.

"We want Philadelphia to stand out as a safe place for the investment of capital for public service. The capitalists of this country are going to invest their money in communities where capital is justly treated and permitted to earn attractive returns and are not going to invest capital in communities where its security is impaired and its productiveness is unduly curtailed by unreasonable legislation, regulation or competition."

Dr. D. F. Wilcox on "Fundamental Planks"

Speaking on "Fundamental Planks in a Public Utility Program," Dr. Delos F. Wilcox, of New York, declared that public utility investments should be placed upon a non-speculative basis and their security should approximate that of municipal bonds.

Dr. Wilcox said that cities should assume that all the well-established utilities will be publicly owned sooner or later, private capital being entirely excluded from the public streets, except as it is loaned to the city. While the development of interurban utilities, the extension of utility service to rural regions and the grouping of a number of cities in relation to a single source of supply often present serious obstacles in the way of separate operation by or for each distinct political unit, Dr. Wilcox assumes that the most appropriate governmental agencies for the operation of these utilities will be developed as the need arises.

The Regulation of Public Utilities as Seen from Different Points of View

Professor Bemis on State Commissions

Prof. Edward W. Bemis, member of the Board of Supervising Engineers, Chicago Traction, said efforts were made everywhere by utilities to secure regulative acts. Home rule seems to have been checked. On the other hand, the California commission has been organized and manned so magnificently that cities are surrendering all their power to it. State commissions are existent in most states, and, said Professor Bemis, "we accept it even though seeking, as in Chicago, to secure separate regulation. We accept it as something that the country will try out for some years to come."

Constructive Policy for Public Service Corporations

"A Constructive Policy for Public Service Corporations" was the title of a paper by Mr. Charles Day, of Messrs. Day & Zimmermann, Philadelphia.

The contributions of the engineer-manager are second in importance only to those of the engineer. These men must harvest the full benefits of which the modern steam power plant is capable. The next step is ways and means of bringing together the trained power-plant employees and the methods in accordance with which the plant must be operated. Maximum power-plant efficiency, however, is not assured through superlative service upon the part of the power-plant operatives alone. Many conditions must be taken into account which originate outside the station. The last and most important principle which has contributed to the splendid efficiency attained in connection with the generation and distribution of electrical energy dictates that the burden of power-plant operation rests in the final analysis upon the management, not upon the power-plant employees. The new policy not only makes high internal efficiency imperative but it also requires that convincing proofs of such results should be available to the public service commissions.

Local Control of Utilities

"How Shall We Control Our Public Utilities?" was the subject of the discussion of Mayor Carter H. Harrison of Chicago. He said that state control is better than no control but that local control is better than state control. It may not be scientific to let each community grapple with its own problems, but that is the method that finally brings results. In the early days when the infant utility was taking a chance of possible failure the investor was entitled to extra return for the hazard. To-day these utilities are entitled to a fair profit and no more.

Personal responsibility will weigh more heavily on a mayor than upon a governor, who is responsible to a larger constituency all of whom are not interested in each decision. Mayor Harrison declared that the personnel of the Public Utilities Commission of Illinois is satisfactory and that all regulation must be reasonable. The most valuable commodity the utility possesses is the right to use the streets. Great good would come from public ownership. Let a municipality operate all its utilities and self-interest will induce each citizen to take a more active part in the affairs of local government. The first requisite of public ownership is a rigid civil service that appoints, holds and promotes absolutely on merit. Without it public ownership would be a public disaster; with it public ownership would be made a great blessing to every community.

Mr. Eshleman on Regulation

Mr. John M. Eshleman, president Railroad Commission of California, in his paper on "What Regulation Must Accomplish if It Is to Be Permanent," said that a public utility is essentially a monopoly, but as an individual is powerless to protect himself against the abuses to which a monopoly might subject him, there must be state regulation to protect the individual. Those who are in charge of regulation should bear in mind that there is one form of competition from which a public service monopoly is not free, and that is the competition for money.

In looking toward the future, Mr. Eshleman believed that the government would go into the public utility field when the advantages of so doing were not overbalanced by the disadvantages. He was not convinced that the private owner had clearly proved that private ownership was always better than public ownership.

Cities and Local Regulation

Mr. S. P. Jones, secretary of the Voters' League, Minneapolis, Minn., made an address on "What Certain Cities Have Accomplished Without State Regulation." While admitting that state regulating commissions have been of substantial service to communities struggling with public utility problems, he said that the bald fact yet persists that it is in cities that have worked out their own salvation that the largest degree of success in rates and service has been achieved. Success in this field, however, cannot be wholly expressed in terms of rates and service. These are emphasized first, for they are the things in utility regulation that appeal most strongly to the public. The greater results are seen in the educational effect upon the community and the preparation it furnishes for the time when public utilities must and will be taken over for community operation.

Public Utility Holding Companies and Their Connection with Public Welfare

Mr. Homer on Holding Companies

Mr. Francis T. Homer, of Bertron, Griscom & Company, New York, in his address on "Holding Companies and the Public Welfare," said that the most serious charge brought against holding companies generally, and therefore including public utility holding companies, is that they afford a most convenient means for overcapitalization. That public utility holding companies, like those in the industrial and railroad field, are susceptible to this abuse cannot be denied. But, on the other hand, they do not offer the same opportunity for overcapitalization because the history of investment in public utility corporations has been one of almost uniform growth in the volume and security of earnings and not one of large fluctuations. Overcapitalization of the operating company in itself is not facilitated in any manner by the instrumentality of the holding company. Public utility holding companies do not result in the centralization of large power for their officers and directors, for the reason that they are usually so financed as to provide them with only such an amount of working capital as can be profitably employed in temporarily financing the subsidiaries, so that in adverse times the bonds and preferred stock of the subsidiaries need not be sacrificed, and so that even in good times the disposition of the securities of the subsidiaries can be postponed until the investment made therein is demonstrative of the increasing earning power of the subsidiaries and the higher grade of credits which its underlying securities should command.

Mr. Homer said that the holding companies can command capital when the separate operating companies could not do so through the sale of their common stock for the reason that conditions local to any one operating company may destroy the earning power of its common stock temporarily, and that this risk makes the investment in such stock more or less speculative, whereas it is unlikely that such reverses would undertake in the same year all or even a considerable part of twenty or thirty operating companies.

Public utilities being actual natural monopolies, for the unobtainable actual competition the holding company substitutes comparative competition in every department of the operating companies. The average of operating economy and efficiency is materially greater in the public utilities which are subsidiaries of large holding companies than in the isolated, unaffiliated companies locally owned and controlled. The advantages arising from uniformity of accounting, from the purchase of material and supplies in volume and the greater credit of the holding company are self-evident.

Of approximately $4,000,000,000 of securities invested in street railways, 81.4 per cent are organized into or affiliated with holding companies. Of the $2,100,000,000 of securities outstanding in the electric light and power business, 82.5 per cent are organized into or affiliated with holding companies. Of the $1,300,000,000 of securities outstanding of gas companies, over 66 per cent are organized into or affiliated with holding companies, so that out of approximately $7,500,000,000 of gas, electric and traction capital 78.5 per cent is now organized into or affiliated with about 140 independent holding companies whose securities are known and bought throughout this country and Europe. The last annual report of the comptroller shows that for the year 1913 the investment holdings of the national banks in public utility issues had increased nearly 20 per cent over their aggregate previous holdings, while their investments in railroad securities decreased over 6 per cent.

Mr. Mathewson on Holding Companies

Mr. Charles F. Mathewson, of Krauthoff, Harmon & Mathewson, counsel for the Consolidated Gas Company, of New York, said that the great majority of public utility holding companies exist to meet a real need. They add immensely to the development and the efficiency of the service of public utilities and inure enormously to the benefit, not only of their immediate customers, but also of the entire communities in which such utilities are established. If, through the medium of a company holding scattered plants, the hazard of the investor is rendered less than it would be if his eggs were all placed in a single basket, he would be willing and could be compelled to accept a lower rate of return upon his capital.

Mr. Mathewson expressed the belief that the centralization of financing and management which is made possible by the holding company, or which is made possible by a centralized holding by any other method, is of vast and growing importance to the development of the company in the line of public utilities and the activities of the community which are dependent thereon or connected therewith. The element of destruction of competition which is said to lead to monopoly is not present; for scattered public utilities at different points never, or only in rare instances, could be competitors with each other. Moreover, being subject to state regulation, their charges to and treatment of consumers may be controlled for the public good, and in certain public utilities, at least, a regulated monopoly is more conducive to the convenience and good service of the public than any amount of competition.

The holding company, Mr. Mathewson concluded, has come to stay because it ought to stay, because it is an instrument of progress and efficiency and development and its elimination would be a misfortune whose consequences would be difficult to calculate, but certainly immense.

Mr. Goodrich on Holding Companies

Mr. James P. Goodrich, director of the National City Bank, of Indianapolis, Ind., said that so far as the existence of public utility holding companies is concerned, no possible objection can be urged. Competition in public utilities is never desirable from the standpoint of either the investor or the public. Public utility holding companies enjoy wider banking facilities, and it will be conceded that in operating, managing and legal direction such companies possess certain advantages. By the policy of checking one plant against another the properties are keyed to the highest point of efficiency.

No holding company, Mr. Goodrich declared, ought to be permitted to acquire only a controlling interest in operating property and manage the whole company in the interest of that controlling share. Holding companies should try to acquire the entire stock interest in the property. They should be required to do so. The fact that holding companies do not have to apply to regulating bodies in connection with the issue of securities is desirable for promoters but cannot be for the advantage of the public or investors.

The speaker had no sympathy with the cry against big business. Public utilities are not entirely financed and they must be kept on good terms with private investors. The failure of regulation must be deferred until municipal affairs are better. Public opinion, however, must require the regulation of holding companies as well as operating companies.

Discussion on Municipal Ownership and Operation of Utilities

Mr. Rosecrantz on Municipal Accounts

Mr. Clarke M. Rosecrantz, a member of the firm of Sullivan & Cromwell, New York, general counsel for the Milwaukee Electric Railway & Light Company, said he had yet to find any instance where an examination of the accounts of municipal utilities will show that their rates have been less than those of privately operated utilities without showing a deficit when proper charges incident to the cost of service were made. If insufficient rates are charged, Mr. Rosecrantz declared, "the non-users must make up the deficit, and their proportion of that deficit will be included in their tax bills. If the public operation of utility companies is likely to be successful, we ought to be able to find without any difficulty that those which have for many years been owned and operated by municipalities have been economically and efficiently operated. The history of our city management shows that the contrary is the fact."

Mayor of Cleveland on Public Ownership

Mayor Newton D. Baker of Cleveland, who, as presiding officer, opened the session on "Municipal Ownership and Operation," said that the movement for municipal ownership is the direct effect of the misconduct of public service corporations. He said that some years ago practically every state legislature and practically every city council had been either corrupted or was under very grave suspicion. In large part these conditions have disappeared.

Mr. Winchester on Municipal Plant

Mr. Albert E. Winchester, manager and superintendent of the municipal plant at South Norwalk, Conn., said in speaking of the origin of the plant that the private company seemed to feel too fully in control of the local field to realize the need of giving heed to the growing seriousness of the situation about its service.

Mr. Winchester said that when he was asked to give a decision on the question of public ownership in instances approaching in similarity of conditions those that South Norwalk had to face it was in favor of municipal ownership, but in many other instances it has been emphatically the other way. Even if service deteriorates, every possible effort to induce a remedy should be made before public replacement is considered. The South Norwalk plant is on splendid terms with the great broad-minded, progressive corporation that has succeeded its one-time vindictive enemy and co-operation reigns where bitter opposition used to control. Neither directly competes with the other. The municipal plant supplies certain districts of the city and a large territory roundabout.

From the beginning South Norwalk's public builders have been protected from politics. The officials are nominated by agreement between the political parties upon a non-partisan basis. The political paths of the employees are unasked and unknown. Mr. Winchester, who has been in charge of the plant from the beginning, said: "Why not submit to the fact that both private and municipal ownership survive and, each having honest adherents, agree that both have legitimate fields to fill?"

Congressman Crosser on Public Ownership

Congressman Robert Crosser of Ohio said that in every other kind of business than public utilities there is competition. The question is whether the monopoly should be supplied by the municipality or a private company. Public ownership will purify politics by freeing the public from control by corporations. The speaker said he wants cheaper and better service, but above all he wants to have the cities purified.

Talk of Mayor Hocken of Toronto

Mayor Hocken of Toronto spoke of the "Operation of the Toronto Hydroelectric System as a Public Enterprise." He said that the results so far had been entirely satisfactory. In the initial operation more than the usual difficulties were experienced. Mayor Hocken said that the existence of the plant had not been destructive to the commercial competitor because the potential opportunities for business were so great that few companies enjoying monopolies realized their opportunities.

Mr. Koiner, of the Pasadena Plant

Mr. C. Wellington Koiner, manager of the municipal works department of Pasadena, Cal., spoke of the operation of the municipal lighting plant in that city. He does not believe that the plant should be operated for revenue. If the municipality had the entire field to itself without competition from a private company it could reduce its rates still further.

Municipal Ownership Abroad

Mr. Frederick C. Howe, Commissioner of Immigration, New York, made an address on "Municipal Ownership—the Testimony of Foreign Experience." Electrical plants, Mr. Howe said, are municipalized to a greater extent than gas plants in England. The reason for this, he declared, is that very few electrical franchises were granted by England until electrical central stations had been established firmly in America and Germany. As many tramways had been taken over then by English communities, the people wanted to co-ordinate the properties.

Current News Notes

Milwaukee Efficiency Society.—Dr. Nelson M. Black, of Milwaukee, addressed the Milwaukee Efficiency Society Nov. 12 on the topic "The Human Eye, and Protective Measures for Keeping It in Working Condition." The necessity of proper lighting was emphasized.

* * *

To Urge Electric Parcel-Post Delivery in Chicago.—The luncheon meeting of the Chicago Section of the Electric Vehicle Association of America, Nov. 10, was given over to a discussion of electric-vehicle delivery in parcel-post service. The Chicago contracts for post-office haulage expire next spring, and it is planned to bring before the local postal authorities without delay the advantages of electric delivery. Mr. W. J. McDowell is the present chairman of the Chicago Section E. V. A.

* * *

Western Society of Engineers.—"The Coon Rapids Low-Head Hydroelectric Development on the Mississippi River Near Minneapolis, Minn.," was the subject of a paper by Mr. J. W. Link, hydraulic engineer for H. M. Byllesby & Company, presented before the Western Society of Engineers, Chicago, Nov. 16. Mr. Link described the hydraulic and structural features of the development, which utilizes a head of 17.5 ft. A total rating of 11,000 kw has been provided for, and power is transmitted to Minneapolis at a pressure of 13,200 volts.

* * *

The Economics of Increasing Lamp Efficiencies.—On account of a dinner and entertainment of the Chicago Electric Club on Monday evening, Nov. 23, at the Hotel Sherman, the joint meeting of the electrical section of the Western Society of Engineers, the Chicago Section of the American Institute of Electrical Engineers and the Chicago Section of the Illuminating Engineering Society has been postponed to Tuesday evening, when it will be held in the rooms of the Western Society of Engineers. The general subject for discussion will be "Electric Lighting—A Factor in Civilization."

* * *

Meeting of Brooklyn Company Section, N. E. L. A.—Mr. Elbert Hubbard was the speaker at the November meeting of the Brooklyn Company Section of the N. E. L. A. held in Association Hall, Nov. 10. Mr. Hubbard spoke on co-operation and, needless to say, held the interest and enthusiasm of his large audience throughout. The address followed the lines of his speech before the Commercial Section at the Philadelphia convention last June. The other feature of the evening was a paper by Mr. James L. Wiltse on "Modern Street Illumination." The membership of the section is rapidly approaching 1000.

* * *

Electrically Equipped Apparatus for Photographing Rapidly Moving Objects.—Motion-picture apparatus requiring 100,000 electric sparks a second for exposing the films has been perfected recently for taking pictures of objects moving with bullet-like rapidity. It is declared that seventy-two pictures were taken of a revolver bullet while moving 10 in. Pictures of a bullet passing through a piece of wood showed a curious phenomenon. The wood showed no signs of stress until the bullet had passed completely through it when splinters appeared, the stick began to split and finally fell in pieces.

Meeting of Empire State Association.—The next midyear meeting of the Empire State Gas and Electric Association will be held in Albany on Dec. 10 and 11, beginning with a session at 2 p. m. on Dec. 10. The delegates will dine together informally on the same evening. There will be two sessions on Dec. 11. The principal subject for discussion at the afternoon session on Dec. 10 will be the handling of complaints of service and bills. Discussion of this question may continue until the session of Friday morning, but it is planned to have at least one session which will be open for any matters that members care to bring up.

* * *

American Physical Society.—Among the papers to be read at a meeting of the American Physical Society to be held in Chicago on Nov. 27 and 28 are several of particular interest to electrical engineers. Two papers by Prof. F. C. Brown and two by Prof. L. P. Sieg will deal with the properties of selenium. Prof. Daniel L. Rich will present a paper entitled "Spark Discharges Between Unlike Metals." Radiation and temperature characteristics of tungsten will be discussed by Dr. A. G. Worthing. Prof. E. H. Williams will discuss the magnetization of an iron-cobalt alloy. Prof. A. D. Cole, Columbus, Ohio, is secretary of the society.

* * *

Educational Committee of the N. E. L. A.—A meeting of the committee appointed to further the relations of the National Electric Light Association and the educational institutions was held in New York on Nov. 16. Mr. John F. Gilchrist, vice-president Commonwealth Edison Company, Chicago, chairman of the committee, presided. There were present also Messrs. W. L. Abbott, C. L. Edgar, H. H. Scott, Arthur Williams, H. H. Norris, H. C. Clifford, O. C. Ferguson, M. C. Beebe, C. F. Harding, C. F. Scott, P. M. Lincoln and G. D. Shepardson. The meeting was called for the purpose of considering details of the four phases of work recently outlined for the committee and delegated to sub-committees on lectures, courses and curriculums, employment of graduates and undergraduates, and supplying information to economic departments. These sub-committees presented informal reports, and as a result of the discussion it is decided to make a canvass of leading central-station men to determine the general results of technical education as they relate to the central-station industry.

* * *

Officers and Prize Winners of the Commonwealth Edison Section, N. E. L. A.—The election of officers of the Commonwealth Edison Section of the National Electric Light Association, as announced at the section meeting Nov. 12, resulted as follows: President, Mr. George B. Foster; vice-president, Mr. J. T. Mountain; secretary, Mr. R. H. Williams; treasurer, Mr. W. A. Fox. Following an address by Mr. Samuel Insull, awards were extended to the men adjudged the successful competitors in a prize-paper contest. Forty papers had been presented, dealing with different phases of the main topic, "How the Commonwealth Edison Company Works." The winners were Mr. E. W. Jones, the Insull medal and a forty-dollar merchandise certificate; Mr. J. T. Mountain, twenty-dollar merchandise certificate, and Mr. W. G. Kelley, ten-dollar merchandise certificate. Prizes in the semi-annual award by the company for meritorious suggestions were given to Messrs. E. C. Pitchard, $50; P. F. Williams, $40; M. J. Morrical, $30; E. J. Reilly, $20; A. F. Schuster, $5, and F. J. Boerner, $5. The association now has 1665 active members.

Hydroelectric Development on Bishop Creek, Cal.—VI

Power house and equipment of station No. 6 of the Nevada-California Power Company—All water leaving station used for irrigation purposes. By C. O. Poole

IN Part V of this article the intake dam of station No. 6 was described. Fig. 50 is a general view of the intake station, while Fig. 52 shows the design of the gravel trap installed in the pipe line.

Power House and Equipment

The power house is of reinforced concrete 31 ft. by 48 ft. and is equipped with a 20-ton traveling crane.

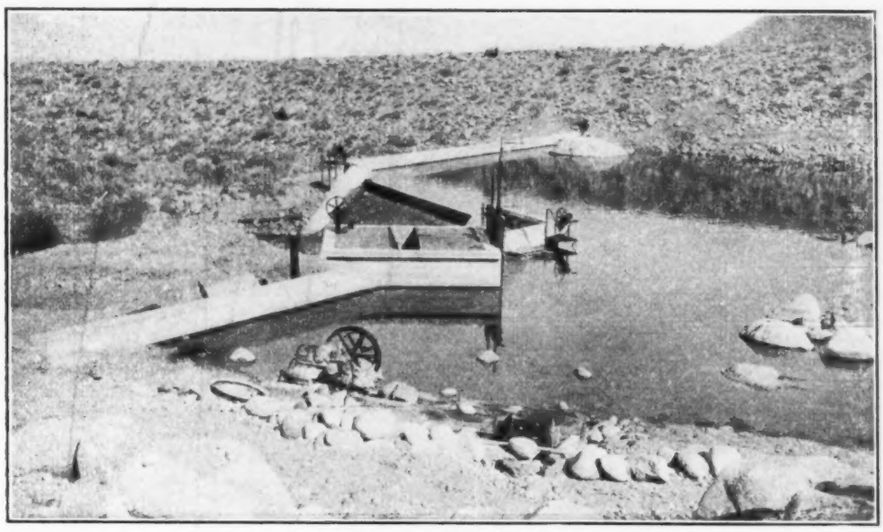


FIG. 50—VIEW OF INTAKE STATION NO. 6

The pressure pipe divides into two branches just outside the station and enters below the floor line by two 36-in. branches through 32-in. gates. The water is led to each waterwheel through two nozzles, there being two wheels, one overhung on each end of the generator shaft. The wheels are of the Pelton-Doble tangential type and drive an Allis-Chalmers 2000-kw, 164-r.p.m. generator wound for 2200 volts, three-phase, sixty cycles. The water is controlled by stream deflectors operated by a Lombard-Doble governor. All the deflectors are operated together by means of rocker shaft and crank arms. Each of the four nozzles is fitted with hand-operated needles which can be set in any position required, and an indicator on each needle gear shows the position of the needles. There is one 60-kw Allis-Chalmers exciter driven by a Pelton-Doble waterwheel and also a 75-hp, 2200-volt induction motor mounted on the same shaft. This motor is floated on the bus all the time. The needle of the wheel is operated by means of a sprocket chain from the switchboard. The switchboard consists of one generator panel and one exciter panel with indicating and registering instrument, synchroscope and Tirrill regulator. Fig. 51 is a view and Fig. 53 a plan of the station.

As all the water from the stream is used for irrigation purposes after it passes this plant, it is quite necessary to keep accurate records of the stream flow. For this purpose a recording stream-flow gage has been designed, and one of these gages is placed on the tailrace of the plant and another in a rating flume placed in the creek bed alongside the tailrace just before the tailrace waters and the creek waters join. These two instruments record the total flow of the stream. Inasmuch as this instrument has been found quite satisfactory in service, a brief description of it is given: Fig. 54 is a general view of the instrument, which consists of an 8-in.-diameter brass drum revolved once in twenty-four hours by a clock and gear. A metal float operates a vertical rack that engages a pinion which rotates a special logarithmic spiral or cam. The latter carries a pencil on a pivoted arm which makes a fine line on the chart that is laid off proportional to the Francis formula, so that the pencil line reads directly in second-feet. By

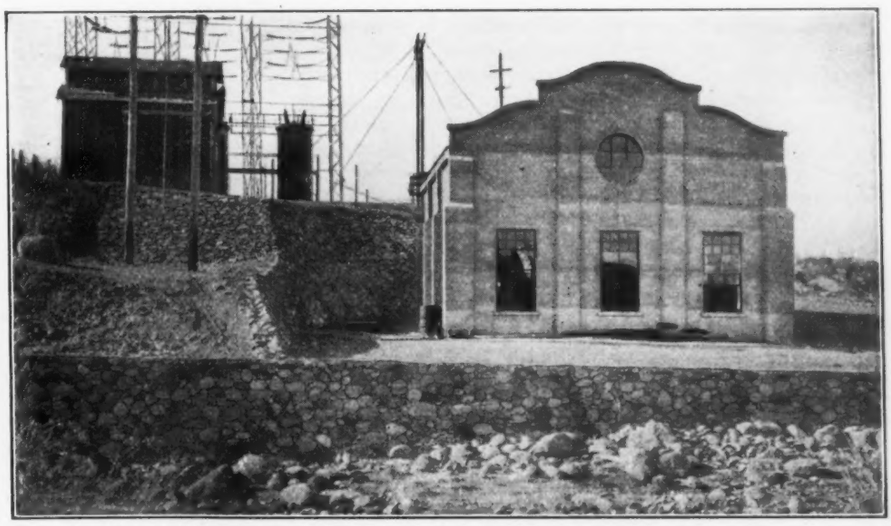


FIG. 51—VIEW OF GENERATING STATION NO. 6

means of a planimeter the area of the chart can be found in a few minutes' time, which multiplied by a constant gives the total cubic or acre-feet flow for the

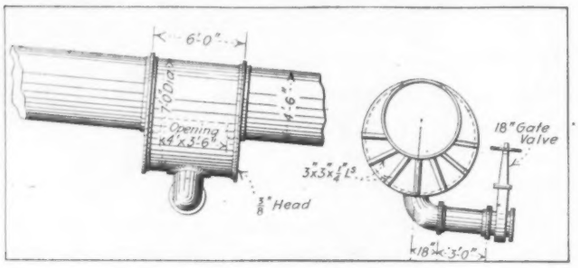


FIG. 52—DESIGN OF GRAVEL TRAP

twenty-four hours. The instrument can be adapted to a flume, tailrace or weir as desired. In addition to the registering drum, there is an indicating dial which tells at all times the depth of water over a weir and the number of second-feet flowing. These recording stream-flow gages can be manufactured in small quantities for $100 each.

Transformers

The transformers for station No. 6 are three 750-kw outdoor-type, water-cooled units furnished by the Westinghouse company. They are wound for 2200 volts on the low-tension side with four 2½ per cent reducing taps. The high-tension side is wound for 87,000 volts delta and 150,000 volts star with four 2½ per cent reducing taps and a tap for 55,000 volts so as to fit in with the Nevada system. Fig. 55 shows these transformers set up together with the disconnecting switches and high-tension bus arrangement. The secondary bus consists of 1-in. copper pipe mounted on special insulators fastened to steel framework. A crane and pit are provided for overhauling the transformers, each transformer being mounted on wheels and arranged so that it can be placed on a transfer truck and brought over the pit. The line from the transformers leads directly on steel poles with suspension insulators to the control station, a distance of 1¼ miles. The wires are No. 0 seven-strand copper and are spaced 10 ft. apart for 140,000 volts.

It is believed the development affords one of the best examples on record of the full utilization of the waters

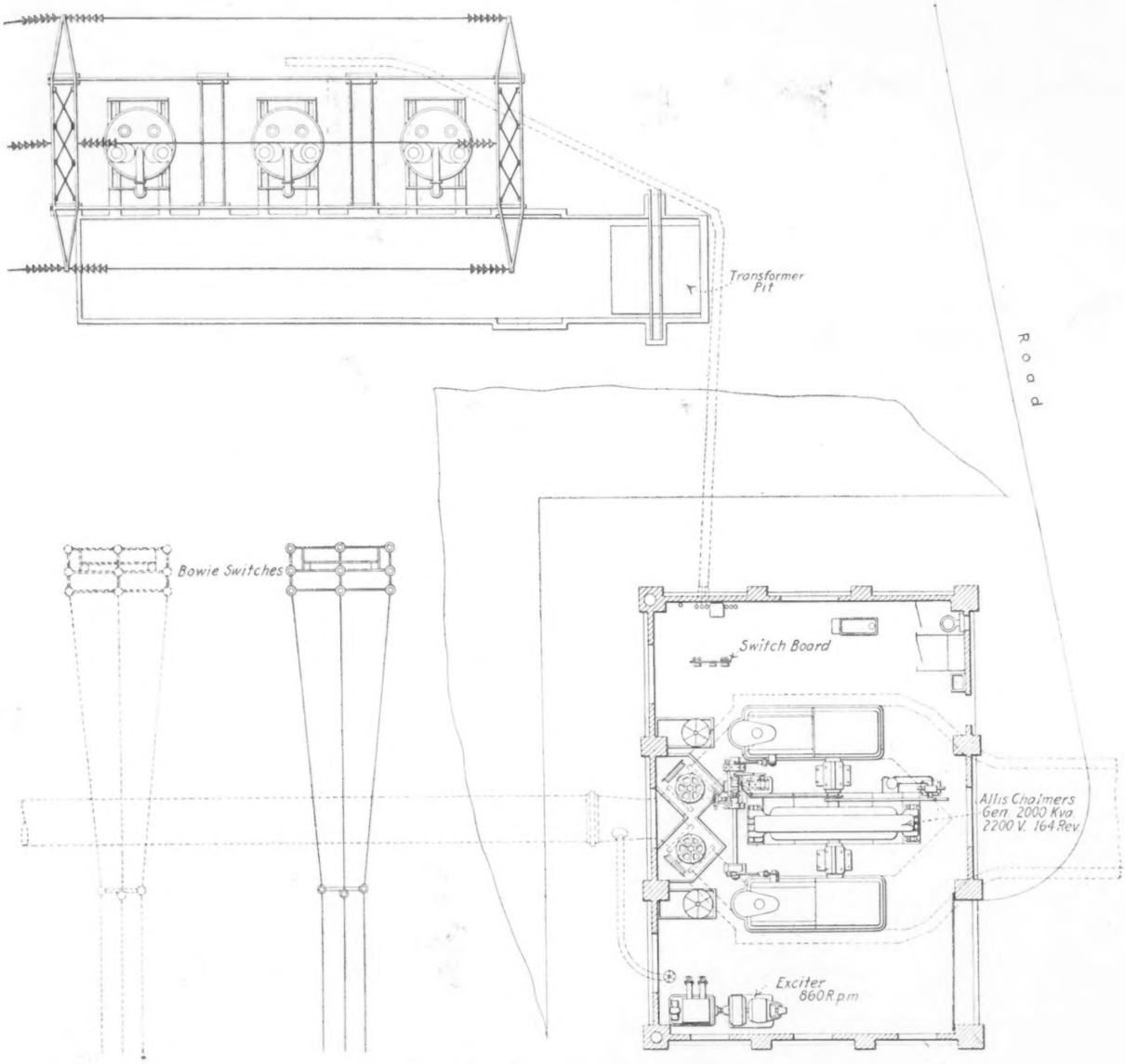


FIG. 53—PLAN OF STATION NO. 6

of a mountain stream. The total difference in elevation from the spillway of the reservoir on the headwaters of the stream to the tailrace of station No. 6

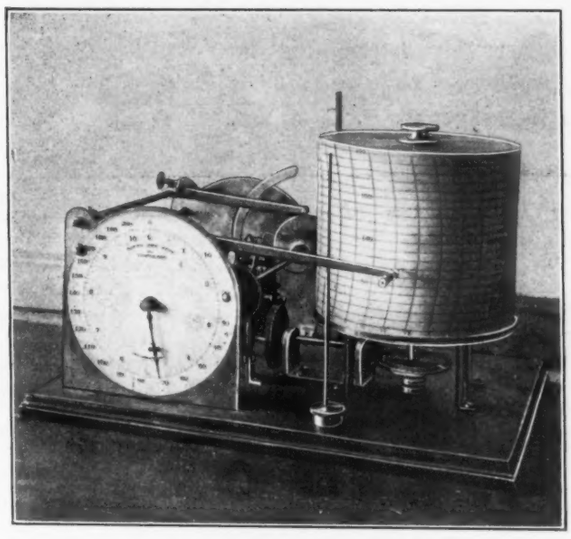


FIG. 54—RECORDING WATER GAGE

is 5070 ft. in a total distance of 15 miles, and all but 70 ft. of this is utilized or will be when stations A and No. 1 are completed as shown in the tabulation printed herewith.

The remaining instalments of this article will describe the transmission systems of the Nevada-California and Southern Sierras companies, including the substations of the former company at Palmetto, Silver

RATING OF THE VARIOUS STATIONS

Plant	Head in Ft.	Kw Rating
A	630	2,500
1	950	6,000
2	950	6,000
3	750	6,000
4	1,053	6,000
5	410	1,500
6	257	2,000
Total.....	5,000	30,000

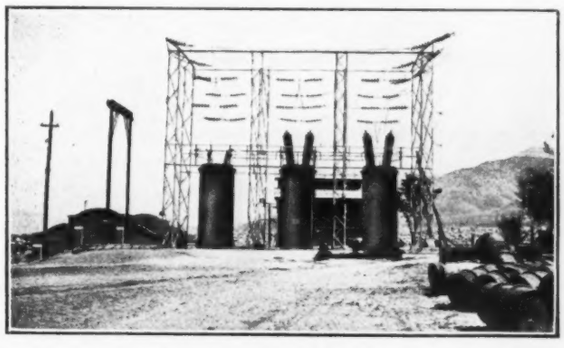


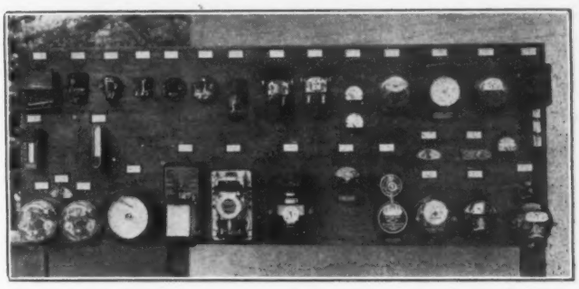
FIG. 55—OUTDOOR TRANSFORMERS AT PLANT NO. 6

Peak, Alkali, Goldfield, Tonopah, Millers, Manhattan and Rhyolite, and the control station of the latter company in Owens Valley, the San Bernardino steam plant and typical outdoor substations.

DEVELOPMENT IN ELECTRICITY METERS

Report Presented at the Edison Companies' Convention Shows Much Progress in Standardizing and Perfecting Their Design

The report of the committee on meters presented at the recent convention of the Association of Edison Illuminating Companies, White Sulphur Springs, W. Va., contained a summary of the year's progress in the production of meters. The expiration of basic patents that had controlled the production of induction meters has placed the sale of that type of instrument on a competitive basis. The tendency now among manufacturers is to simplify and standardize the parts of alternating-current meters, so that a single design now suffices for single-phase and polyphase systems. While the designs and prices of standard commutator meters remain practically unchanged the price of repair parts has been advanced considerably. It was reported that Prof. Elihu Thomson has been developing a small commutator-type meter which will probably reduce the overhead cost of supplying electricity to small consumers. Shunt meters are now available from several manufacturers for integrating large amounts of power which formerly had to be measured by series instruments with limited ratings. Tests have been made of ampere-hour meters showing them to have a high degree of accuracy. About twelve central-station com-



SOME OF THE INSTRUMENTS WHICH WERE INVESTIGATED BY THE METER COMMITTEE

panies in this country are subjecting a new electrolytic meter to comparative tests to ascertain its adaptability to measuring small amounts of energy. The committee also reported that the Second District Public Service Commission of New York has withdrawn its order prohibiting the use of ampere-hour meters.

Working in conjunction with manufacturers, the committee has done considerable in standardizing design and construction details of meters. Further, a standard schedule of ampere ratings for watt-hour meters has been adopted, and efforts have been made toward improving the maintenance of meters. Probably 75 per cent more of the routine tests are now made on the one-man basis instead of by two-men teams, this procedure being made possible through the development of lighter testing equipment. Attention was called to the fact that the Bureau of Standards is now preparing a complete tabulation of existing state laws, public service commission rules and city ordinances relating to the supply of electricity. Prepayment meters are being made by some manufacturers. The committee has correlated many facts on the following topics: The duration of demand interval and period over which it extends; possibilities and limitations of different types of instruments for showing the correct demand factor; delivery of energy under maximum-demand contracts, and the diversity factors characterizing large and small systems.

A Method of Testing Instrument Transformers

The use of induction watt-hour meters for determining the differences in ratios and phase angles between two "voltage" or two "current" transformers of the same range. By P. G. Agnew

ATTEMPTS to determine the constants of instrument transformers by using wattmeters or watt-hour meters in both the primary and secondary circuits have not met with much success. Modern transformers have such good characteristics that the small differences to be measured are more or less masked by the unavoidable errors of measurement. Moreover, such a method is not applicable to high voltage or large current ranges, which are commercially the more important.

Modern induction watt-hour meters can, however, be used to determine the difference in ratios and also the difference in phase angles either of two "voltage" transformers or of two "current" transformers, provided the two transformers are of the same range. If, then, the ratio and phase angle of one of the transformers are known, it may be treated as a standard transformer and the constants of other transformers determined in terms of the constants of the standard. Several modifications of the potentiometer method are available for the precise determination of ratio and phase angle, for the most part making use of laboratory instruments.*

Outline of Method

For voltage transformers an auxiliary current is passed in series through the current coils of the two meters, which are duplicates, and the voltage coil of each meter is connected to one of the transformers. If the meters were adjusted to precisely the same rate, the ratios of the transformers would be inversely proportional to the number of rotations of the meters in a given time. Practically the meters cannot be adjusted to precisely the same rate, but the difference in rates may be eliminated by interchanging the meters.

The difference in the phase angles may also be determined by changing the phase of the auxiliary current so that the meters are working on low power-factor, since this difference in phase makes the meters run at different speeds, as they are connected to one or the other of the transformers. From these data and a knowledge of the difference in ratios obtained at unity power-factor the difference in phase angles can be calculated. A diagram of connections for testing a "voltage" transformer by this method is shown in Fig. 1. The ratio measurement may be carried out with a single-phase source of supply. If a three-phase source is available, it is convenient to use a lamp bank for the auxiliary current, putting it on the same phase with the transformers for the ratio measurement and on either of the other phases for the phase-angle measurement.

Fig. 2 shows the arrangement of circuits for testing "current" transformers. The use of the current and the voltage coils of the meters is inverted in respect to their use in the case of the "voltage" transformer. The primaries of the "current" transformers are in series, and the current coils of the two meters are connected alternately to the two transformers. An auxiliary voltage is applied to the voltage coils of the meters. Otherwise the tests are carried out in the same way as for the voltage transformer.

Let m_a, m_b = the rates of the two meters (the rate being the ratio of the recorded watt-hours to the true watt-hours).
k = the disk constant of the meters (nominal watt-hours per revolution).
R_1, R_2 = ratios of transformers.
α_1, α_2 = phase angles of transformers (positive for the secondary leading opposition to the primary).
a_1, a_2 = number of turns made by meter A when connected to transformers Nos. 1 and 2 respectively.
b_1, b_2 = the same for meter B.
$\cos\theta$ = power-factor.

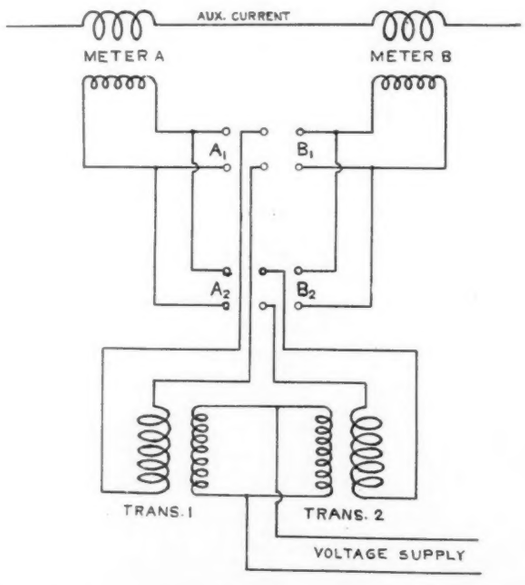


FIG. 1—DIAGRAM OF CONNECTIONS FOR COMPARING "VOLTAGE" TRANSFORMERS

Consider the case of a meter connected to a "voltage" transformer and working on low power-factor with a lagging current. In making t turns a meter records tk watt-hours. Taking into account only the rate of the meter m and the ratio of the transformer R, this gives for the energy represented by the primary voltage and the auxiliary current $\frac{m}{tk} R$. But the meter is working

*Agnew and Fitch, *Electrical World*, Vol. 54, p. 1042, 1909; E. Orlich, *Elek. Zeit.*, Vol. 30, pp. 435, 466, 1909; L. T. Robinson, *Trans.* Amer. Inst. Elec. Engrs., Vol. 28, p. 1005, 1909; F. A. Laws, *Electrical World*, Vol. 55, p. 223, 1910; Sharp and Crawford, *Trans.* Am. Inst. Elec. Eng., Vol. 29, p. 1517, 1910; Agnew and Silsbee, *Proc.* Am. Inst. Elec. Eng., Vol. 31, p. 1267, 1912; Schering and Alberti, *Archiv für Elektrotechnik*, Vol. 2, p. 263, 1914. A method of testing voltage transformers adapted to central-station use and requiring only portable instruments has been described by Brooks (*Electrical World*, Vol. 62, p. 898, 1913.)

at a power-factor of cos $(\theta + \alpha)$ instead of cos θ, and hence the expression for the energy finally becomes

$$\frac{tkR \cos \theta}{m \cos (\theta + \alpha)}$$

or

$$\frac{tkR}{m \cos \alpha (1 - \tan \alpha \tan \theta)}$$

or, since α is very small and hence its cosine may be taken as unity,

$$\frac{tkR}{m (1 - \tan \alpha \tan \theta)} \text{ approximately.}$$

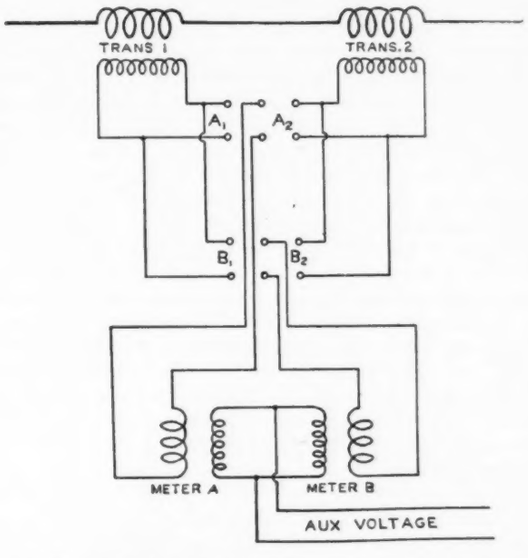


FIG. 2—DIAGRAM OF CONNECTIONS FOR COMPARING "CURRENT" TRANSFORMERS

Applying this to a set of readings taken by interchanging the meters on the transformers

$$\frac{a_1 kR_1}{m_a (1 - \tan \theta \tan \alpha_1)} = \frac{b_2 kR_2}{m_b (1 - \tan \theta \tan \alpha_2)} \quad (1)$$

$$\frac{a_2 kR_2}{m_a (1 - \tan \theta \tan \alpha_2)} = \frac{b_1 kR_1}{m_b (1 - \tan \theta \tan \alpha_1)} \quad (2)$$

from which it may easily be shown that

$$\frac{R_2}{R_1} = \sqrt{\frac{a_1}{a_2} \cdot \frac{b_1}{b_2}}, \quad (3)$$

where the a's and b's are readings taken at unity power-factor, and that

$$\tan \alpha_2 - \tan \alpha_1 = \frac{1}{2 \tan \theta} \left(1 - \frac{a_2}{a_1} \cdot \frac{b_2}{b_1} \cdot \frac{R^2_2}{R^2_1}\right), \quad (4)$$

where the a's and b's are now readings taken at low power-factor.

Equation (3) is the general formula for the ratio R_2 in terms of the ratio R_1, and (4) is the general formula for the phase angle α_2 in terms of α_1 and the ratio of the ratios.

These formulas may easily be put into convenient form for slide-rule computation by making a few allowable approximations, giving for the difference in ratios expressed as a fraction of the ratio of the standard transformer

$$\frac{R_2 - R_1}{R_1} = \frac{1}{2} \left(\frac{a_1 - a_2}{a_2} + \frac{b_1 - b_2}{b_2}\right), \quad (5)$$

and for the phase angle

$$\alpha_2 \text{ (in minutes)} = \alpha_1 + \frac{3438}{\tan \theta} \left[\frac{a_1 - a_2}{2 a_1} + \frac{b_1 - b_2}{2 b_1} - \frac{R_2 - R_1}{R_1}\right] \quad (6)$$

Equations (5) and (6) are the working formulas for ratio and phase angle respectively and may ordinarily be used instead of the more exact formulas (2) and (3). The approximations involved will amount to less than 0.1 per cent in ratio for differences in the formula not exceeding 3 per cent, and to less than 0.01 per cent in ratio for differences not exceeding 1 per cent.

In equation (6), which gives the phase angle, the signs are correct for "voltage" transformers connected to meters working on lagging current and for "current" transformers connected to meters working on leading current. If the conditions are reversed, the plus sign before the bracketed expression should be changed to minus. However, it may often be more convenient not to depend upon this relation but to use the following facts as criteria to determine experimentally whether the transformer under test has a greater or a smaller phase angle than the standard transformer:

(1) Adding a non-inductive load to a "voltage" transformer always tends to lag the secondary voltage.

(2) Adding inductive resistance in the secondary of a "current" transformer tends to advance the phase of the secondary current.

DATA OBTAINED WITH METERS IN PARALLEL ON SAME LOAD

Run	Per Cent of Full Load	Number of Turns	
		Meter A	Meter B
1	100	100	100.126
2	100	100	100.123
3	100	100	100.124
4	100	100	100.127
5	100	100	100.140
6	100	100	100.135
7	100	100	100.136
8	10	10	10.063
9	10	10	10.067
10	10	10	10.061
11	10	10	10.068
12	10	10	10.066

Experimental Results

Fig. 3 shows the results of the test of a 5500-to-110-volt transformer by means of two watt-hour meters and another transformer used as a standard, compared with the results of a precision laboratory method. The full lines represent the results of the laboratory method, and the isolated points those of the watt-hour meter method. Each point is the average of two runs of 100 turns each, and readings were taken to 0.01 turn.

Similarly, Fig. 4 shows the results of a comparison of the two methods for a 25-to-5-amp "current" transformer. Each point is here also the average of two runs of 100 turns each, excepting at the lower currents, where fewer turns were taken.

The meters used were of the type known commercially as K_2, the disks of which had been graduated in hundredths of a revolution.

It will be seen that the accuracy obtained is greater than is required in commercial power measurements. The method is easily capable of determining ratio to 0.02 or 0.03 per cent and phase angle to one or two minutes.

It has been found possible more than to double the speed of the meters by shunting the magnets by small pieces of soft iron and yet get equally accurate results. It is not generally realized that, under the very best con-

ditions, modern induction meters will repeat consecutive runs to a precision of about 0.01 per cent at full load. This is clearly shown by the table giving observations taken with the meters in parallel on the same load. The tenths of a division (thousandths of a revolution) were estimated in taking readings. The speed of

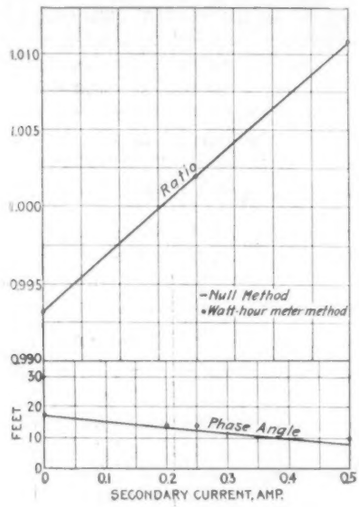


FIG. 3—RATIO AND PHASE ANGLE OF "VOLTAGE" TRANSFORMER

the meters had been increased to double normal value by shunting the magnets.

Over-All Corrections for Ratio and Phase Angle

There are cases in which it may be convenient to obtain a lump correction for both the ratio and the phase angle rather than to determine them and to correct for them independently. For example, in the case of a watt-hour meter and "current" transformer metering the energy supplied to an induction motor, if the standard transformer is inserted in series with the line and readings are taken at whatever power-factor the system is operating under, then one may consider R_2 in either equation (3) or equation (5) as the combined or over-all power ratio of the transformer. To carry this out in routine work, it would practically be necessary to have a set of curves for the standard transformer giving this ratio calculated from ratio and phase angle for various power-factors. Yet, since these curves would be computed once for all for the standard transformer, it would obviate the necessity of going through a somewhat complicated computation for each transformer tested. Of course, a similar method could be developed for the case of the "voltage" transformer, but the complications involved would hardly make it worth while for that transformer alone. In fact, good "voltage" transformers, at least at sixty cycles, have such small phase angles that in most work the error introduced by them is no greater than the uncertainty due to other causes.

This process may be extended to the case in which both "current" and "voltage" transformers are used. For such a test one meter would be connected to both of the standard transformers (current and voltage), the other to both the transformers under test. Either equation (3) or equation (5) will in this case give the over-all power ratio of the two transformers under test (R_2) for the given condition in terms of the corresponding over-all ratio for the two standard transformers (R_1). This latter quantity could be taken from curves calculated for the two standard transformers, as mentioned above. Experimentally the process is simpler than would appear at first sight, since no auxiliary current or voltage is required. This method should prove useful in checking the transformers used in the metering of large blocks of power, either single-phase or three-phase.

Miscellaneous Details

The use of two of the portable watt-hour meters so largely employed in meter testing is much more convenient than that of the house-type meters with graduated disks, as the trouble of counting turns is eliminated. However, for economy of time in testing "current" transformers rated at 5 amp secondary current a 5-amp watt-hour meter is preferable to one of a 10-amp range, as the length of time required for a test with a given accuracy is roughly only half as great. In general, a 1-amp or 2-amp range cannot be used on the light loads, as the impedance which would be introduced in the secondary of the transformer would be prohibitive. Of course, in the case of a voltage transformer the range is immaterial, as the current is an auxiliary one.

In testing "current" transformers it is very convenient to use as a source of current a step-down transformer giving only a few volts on the secondary but having ample secondary current-carrying capacity. But in such an arrangement if the resistance in the secondary circuit is very low the current may lag very appreciably behind the voltage. This will produce a small error in the ratio measurement, but such a condition is readily detected by the measuring instruments in the circuit. The best way to overcome this difficulty is by the use of a phase-shifting transformer as a source of the auxiliary voltage. Such a transformer is of very great utility for many other purposes, such, for example, as testing meters at low power-factor. If such a device is not available, the error may be eliminated by a process of successive approximation.

Care must be used to open the secondary circuit of a "current" transformer while current is passing through the primary, for if this be done the properties of the iron will be altered and the ratio and phase angle increased. In case a transformer is accidentally open-circuited, it may be brought back to its normal condition by carefully demagnetizing.

It is well to open both the current and the voltage circuits of the meters at the end of a run, as some meters are more apt to creep on current alone than on voltage alone.

It is important that the ratio and the phase angle of the standard transformer, whether of the "current" or "voltage" type, be determined under actual working conditions of load, including the meter. Multiple-range

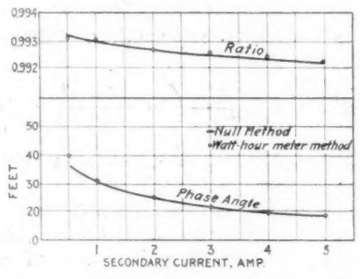


FIG. 4—RATIO AND PHASE ANGLE OF "CURRENT" TRANSFORMER

transformers are very convenient as standards, and good transformers have very accurately the same constants for the different series-parallel arrangements of coils. If the no-load ratio of a voltage transformer be required, it may be obtained very closely by adding a second or duplicate meter as load and then extrapolating to the no-load condition.

While the present method has neither the high precision nor the elegance of the null laboratory methods, it has ample accuracy for commercial requirements, it is independent of ordinary line fluctuations, and no specialized apparatus is required.*

A SPINNING COMPANY'S POWER PLANT

Reciprocating Engine and Mixed-Pressure Turbine Installation with Special Cooling Tower and Synchronous Motor Equipment

The power plant of the Jenckes Spinning Company, of Pawtucket, R. I., illustrates the marked tendency that now exists in industrial generating station design toward the use of equipment combinations planned for economical service. This establishment produces fancy cotton yarns, dress goods and tire fabrics, besides other textiles. It employs 1200 operatives on day and night shifts and operates about 43,900 spindles. The machinery is both mechanically and electrically driven, the latter service requiring sixty-eight 550-volt, three-phase induction motors aggregating 1245 hp and seven 550-volt direct-current motors of 225 hp total rating.

Four Babcock & Wilcox boilers furnish steam, there being one 250-hp, one 500-hp and two 500-hp units installed. The 400-hp boiler is used only for heating. In the engine room are installed two Harris-Corliss simple engines exhausting into a 1000-kw mixed-pressure Curtis-General Electric turbo-alternator delivering three-phase energy at 600 volts; a 395-hp, 600-volt, three-phase General Electric synchronous motor, and a 250-kw, 550-volt direct-current generator. The engines are rated at 500 hp and 850 hp respectively, their cylinder dimensions being 24 in. by 48 in. and 30⅞ in. by 60 in. The engines are belted to the line-shaft system of the mill, as are the synchronous motor and direct-current generator. The condensing equipment and a large cooling tower associated with it are of special interest and were furnished by the C. H. Wheeler Manufacturing Company, of Philadelphia. The accompanying sketch shows the general arrangement of apparatus.

The 250-kw direct-current generator is constantly operated from the line shafting. The generator of the mixed-pressure unit and the synchronous motor are run in parallel on the 600-volt, three-phase buses, and the synchronous machine operates either as a generator or as a motor, according to the load on the turbine. In the original plant three reciprocating engines were installed, but the present arrangement, by which the exhaust steam from two engines is utilized in a mixed-pressure turbine, practically doubles the output of the two engines now in service. The use of the synchronous motor in conjunction with the turbo-generator enables the latter to assist in driving the line shafting when the mechanical load is increased, and it provides a means of automatically increasing the load upon the engines and thus adding to the steam delivered to the mixed-pressure turbine when the alternating-current motor load rises above normal. The power-factor varies from 90 per cent to 95 per cent.

The engine exhaust, consisting of 10-in. and 12-in. pipes, is carried to a 4-ft. diameter by 5-ft. separating receiver in a 16-in. trunk line, and a pipe of the latter size is continued to the turbine. Just before the turbine is reached, a connection is made to a 16-in. Atwood & Morrell atmospheric exhaust valve set for 3 lb. The turbine operates at 1800 r.p.m. and delivers sixty-cycle energy to the bus. It exhausts into a No. 58 C. H. Wheeler surface condenser through a 36-in. connection, an atmospheric connection being provided between the turbine and the condenser. The condenser is placed in the basement, and the vacuum is maintained by a 20-in. by 40-in. "Rotrex" wet and dry air pump directly driven by a 7-in. by 7-in. vertical engine. From the pump the condensate flows into a hot-well, whence it is forced through a feed-water heater into the boilers by a Deane 12-in. by 7-in. by 12-in. feed pump, the heater being of the Worthington closed type. Provision is made for introducing city water into the hot-well for make-up purposes and for the usual introduction of auxiliary exhaust steam into the heater. Condensation forming in the receiver between the engines and turbine is delivered to a sewer connection by a 4½-in. by 2¾-in. by 4-in. Deane duplex pump.

The circulating water is supplied to the condenser upon the balanced water-leg principle, the cooling-tower supply and discharge pipes being parallel between the condenser and the tower. The tower is one of the largest in New England and is 90 ft. long, 20 ft. wide and 35 ft. high, weighing about 150 tons under actual working conditions. It is mounted upon the roof of the mill and has a total capacity of 5000 gal. per minute. It is supported at the ends and on one side by brick building walls carried above the roof level. Ten

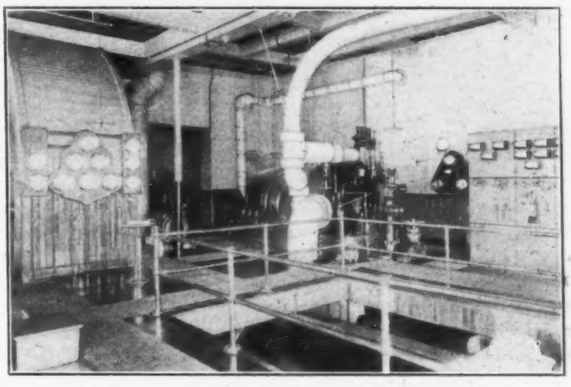


FIG. 1—ENGINE ROOM, JENCKES SPINNING COMPANY

10-in. lateral I-beams and two rows of 15-in. longitudinal I-beams are used in its support, and on the outer side the tower is braced by ten 6-in. by 7-in. wooden stanchions. The longitudinal I-beams are supported on cast-iron columns extended from the upper floor of the building and provided with special foundations. In the tower proper are a large number of wooden separators 8 ft. long and 1½ in. square, set on the diagonal to interrupt the falling water and provide additional exposure to air currents. The circulating water is forced into the top of the tower by a 16-in. centrifugal pump directly driven by a 70-hp Terry steam turbine, but although the top of the cooling tower is about 100 ft. above the condenser, the pump is obliged to work only against the nominal head and pipe friction represented by the difference between the top and bottom heights of the tower, on account of the balancing secured between the supply and discharge pipes. These are each 15 in. in diameter. The piping is arranged so that if the turbine should be shut down the engines can be operated condensing.

The height of the water in the receiving tray at the bottom of the tower is indicated on a calibrated gage board in the engine room. The board carries a row of incandescent lamps which burn as the water reaches various stages, the lamps being thrown into circuit by brass contacts operated by a float carried in a wood-

*A more detailed description will appear soon in the Bulletin of the Bureau of Standards, Reprint No. 233.

incased copper cylinder at the tower level, the float being kept free from freezing in winter weather by a ½-in. steam jet which plays upon it. In case of extreme low or high water in the tower tray the contacts cause an alarm bell to ring in the engine room.

Energy for exciting the turbo-generator and synchronous motor fields is normally derived from a 25-kw,

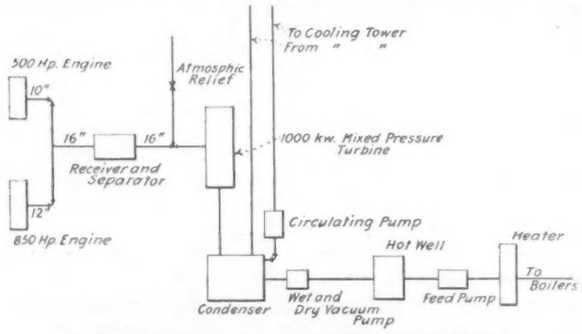


FIG. 2—DIAGRAM OF EXHAUST PIPING

125-volt motor-driven generator, a 15-kw Curtis turbine set being provided for starting and emergencies. The plant is equipped with a number of indicating and recording instruments showing, in addition to the usual steam-pressure and vacuum conditions, the temperature of the exhaust from the turbine and the temperature of circulating water going to and coming from the tower. Three Foxboro recorders are also in use to maintain records of the temperature of the field of the turbo-generator, temperature of feed water and the steam pressure. All feed water is measured by Venturi meters.

Through the courtesy of the company the following test data are printed. The runs were made under ordinary day and night loads and for seventy-two continuous hours. The coal had a heat of combustion as fired of 14,680 units per lb., showing 83 per cent carbon and 6.9 per cent ash upon analysis. On the day test, when the conditions were most favorable, 10.34 lb. of coal was burned per sq. ft. of grate surface per hour; on the night test, 7.95 lb., and on the seventy-two-hour run, 9.25 lb. The equivalent evaporation from and at 212 deg. per lb. of combustible per hour was

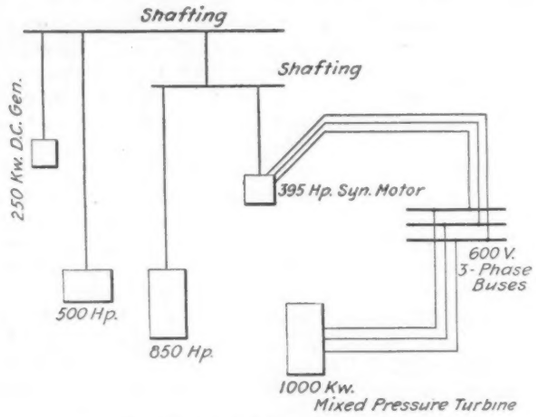


FIG. 3—ARRANGEMENT OF EQUIPMENT

respectively 12.33 lb., 11.34 lb. and 11.91 lb. The air required per pound of coal as determined from flue-gas analysis was 28.2 lb., representing an excess of 161.5 per cent over theoretical requirements. The thermal efficiency of the boiler plant was 75.4 per cent on the day run, 69.5 per cent on the night run and 72.8 per cent on the seventy-two-hour test. On the day test the boilers were run at about 75 per cent of their rated capacity; on the night run at less than half their rating.

For the entire plant, the output averaged 2008.6 hp on the day run, 867.7 hp at night and 1578.7 hp for

DATA ON STEAM AND COAL CONSUMPTION

	Day Run	Night Run	72-Hour Run
Lb. steam per lb. coal	10.92	10.19	10.64
Lb. coal as fired per hp-hour for total plant	1.23	2.21	1.41
Lb. steam per hp-hour	13.50	22.40	14.97
Thermal efficiency in per cent	14.15	7.94	12.40
Useful electrical output in hp	1001,00	434.50	642.00
Total output of plant, including engines and generators in hp	2008.60	867.70	1578.70

the seventy-two-hour run. The steam and coal consumptions were as shown in the accompanying table.

The operating cost at the plant per kilowatt-hour averages about 6 mills. The mixed-pressure turbine, cooling tower and condenser installation cost about $65,000, and it is estimated that the economies gained

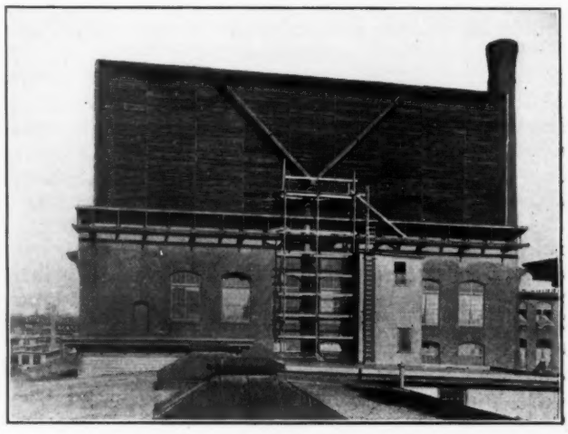


FIG. 4—COOLING TOWER, JENCKES SPINNING COMPANY

by its use will pay for the new equipment in less than three years. Mr. C. H. Giles, of Providence, R. I., was consulting engineer in connection with the plant betterments described, the chief operating engineer being Mr. Charles Tefft.

Making the Customer a Party to His Own Complaint Search

By arranging an extra cord connection on its complaint-department telephone desk a Middle West utility company provides means by which the customer who telephones in a "kick" can listen to the various conversations all the time the complaint clerk is calling up different departments in search of the cause of trouble. In this way the complainant becomes a third party to the conversation and can interpose suggestions at any time if the statements of the complaint clerk as repeated are at variance with the facts or if additional information is needed. The scheme has also the additional advantage that the complainant is spared a tedious wait listening into a "silent" telephone receiver, while the investigation is being made. By following the course of his complaint as it makes the rounds of the various departments, the customer can be satisfied that his needs are being given prompt attention.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods and Current Practice Among Successful Utilities

Electricity Lights the Country Church

Churches even in towns of moderate size are not as a rule considered profitable customers for the central station on account of their low load-factor. Despite this fact, however, the Noblesville (Ind.) Heat, Light & Power Company has connected seven country churches to its extensive system of rural electric-service lines. In the contracts for service these churches are treated on the same basis as ordinary farm customers, and each is required to make a deposit of $50 to cover one-fourth of the line construction expense. Later this deposit is returned to the church in electrical energy, no charge being made for service until after $50 worth has been used. The illustration herewith shows one of these churches, a little white frame structure, more than 6 miles from the generating plant at Noblesville. The transformer serving this installation is placed on a

ELECTRICALLY LIGHTED CROSSROADS CHURCH IN INDIANA

pole across the road and is not visible in the illustration. The meter hangs under the porch roof so that the meter reader on his quarterly rounds does not need to enter the building.

Load Curves Which Vary from the Average

An observant utility manager in the Central West has had plotted average energy-consumption curves for different types of customers. On the same sheet with each average curve there are added curves based on data of the individual customers making up the average. With these curves an opportunity is afforded for comparing each patron's consumption with the average. A parallel study of the curves and of the customers' installations generally brings out ideas for increasing the low points in each of the curves.

Taking hotels as an example, it may be found that the summer peak of a certain installation is far above normal. A study of the conditions existing at that hotel in the summer may point to ways for increasing the business of other hostelries and may also show how the winter business at the first hotel may be brought to a higher level.

Nitrogen Lamps Displacing Gas at Worcester, Mass.

The Worcester (Mass.) Electric Light Company is meeting with success in displacing gas lamps of various types with gas-filled incandescent units. The two accompanying illustrations indicate the improvement effected in the factory of the Cranska Thread Company by the substitution of five 400-watt nitrogen-tungsten

FIG. 1—FORMER GASLIGHT ILLUMINATION

lamps for twenty-eight open gas jets long used to illuminate the first floor of the establishment. This section of the factory is about 50 ft. by 80 ft. in dimensions, and the gas-filled lamps are installed about 11 ft. above the floor and are equipped with metal reflectors. As a result of the improved illumination gained by the company, other manufacturers in the neighborhood are estimating on installations of nitrogen units in place of

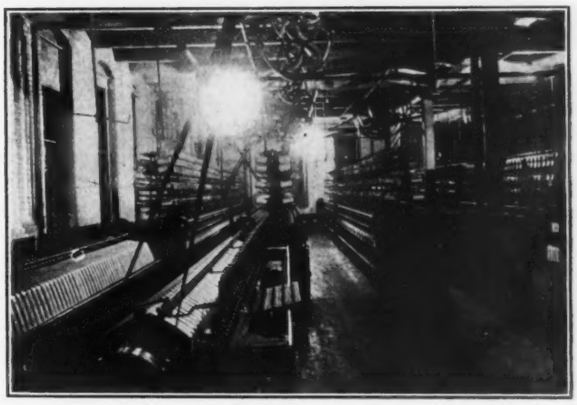


FIG. 2—NEW ELECTRICAL ILLUMINATION

carbon and ordinary tungsten lamps. The Worcester Electric Light Company is also introducing the nitrogen lamp, usually of the 400-watt size, into various large stores, notably shoe and furniture establishments, the semi-indirect system being recommended. Popular interest is rapidly growing with respect to this latest form of illumination.

Reducing the Necessary Sales Effort

Salesmen soliciting house-wiring business frequently encounter a great deal of doubt and prejudice in the minds of the prospective customers concerning the accuracy and honesty of the meter which must accompany the installation. This is quite natural, or seems to be at least, for the salesman is asking the customer to buy a commodity which the latter does not understand, which is measured by a standard of which he has no knowledge and by instruments owned, controlled and kept in order by the agents of the seller. In fact, practically everything that accompanies the use of electrical energy is mysterious to the prospective customer, and it is little wonder that he hesitates to buy.

As a means of dispelling some of this suspicion and getting prospective customers to think and talk about things electrical as they should Mr. E. J. Condon, of the Indiana Utilities Company, Angola, Ind., suggested at the recent Indiana Electric Light Association convention that cards telling how to read an electric meter be mailed to prospective customers before solicitors were sent to call on them. These cards, he declared, are great prejudice eradicators and save the solicitors' time.

Battery-Charging Load Desirable, Declares Philadelphia Company

Vehicle battery-charging loads are particularly desirable for central stations as they can be utilized to fill in valleys in daily load curve. Moreover, each battery

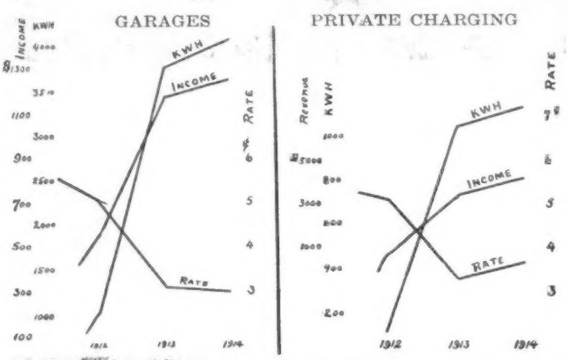


FIG. 1—CURVES SHOWING INCREASED INCOME EVEN WITH DECREASING RATES

load has a high load-factor. Reports from the Philadelphia (Pa.) Electric Company show a monthly average consumption of 102 kw-hr. per vehicle hp connected in public and private garages. One of this company's consumers declares that 199 kw-hr. is being consumed in his garage per month per hp connected. Whichever figure is assumed to be nearer the average value, it can be seen that battery charging is a better revenue producer than most other classes of business. The benefit which the Philadelphia company has derived either directly or indirectly from charging vehicle batteries is shown by the curves in Fig. 1, prepared by Mr. R.

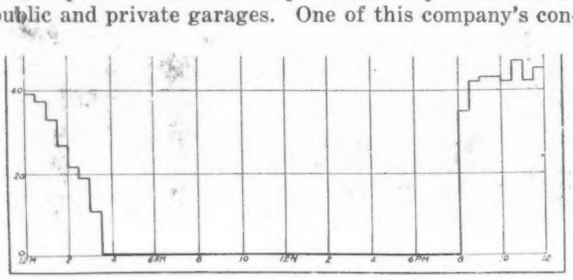


FIG. 2—BATTERY-CHARGING LOAD CURVE IN A PRIVATE GARAGE—TRUCKS

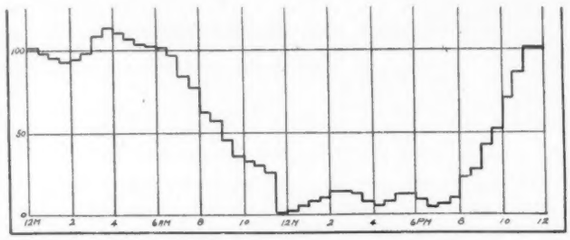


FIG. 3—BATTERY-CHARGING LOAD CURVE IN A PUBLIC GARAGE—PASSENGER CARS

Louis Lloyd, of that company. Load curves for truck and passenger vehicle charging in private and public garages respectively are also shown herewith.

Reasons for Abandoning Appliance-Display Policy in Favor of Direct Sales

About a year ago the Utah Power & Light Company, of Salt Lake City, Utah, opened a new appliance display room and "electric shop" at 154 Main Street, Salt Lake City, to supplement the general offices of the company, which are less conveniently situated. At the outset the company did not plan to sell electric appliances at this new shop, but purposed to have devices there purely for display and educative purposes, intending to refer prospective purchasers to the electric supply dealers of the city who handle these appliances. Careful observation of the practical operation of this plan of conducting a demonstration room has convinced the company officials, however, that the results secured do not justify the expense of operating a demonstration on the elaborate scale that the company has provided for.

The sales force, for example, found it difficult to stimulate the interest of prospective purchasers as soon as the latter had learned that they could not purchase the appliances from the company. The sales people themselves could not go into a selling talk with the same spirit, knowing that they would be unable to derive the benefits of their enthusiasm by closing a sale.

Aim to Please Local Dealers

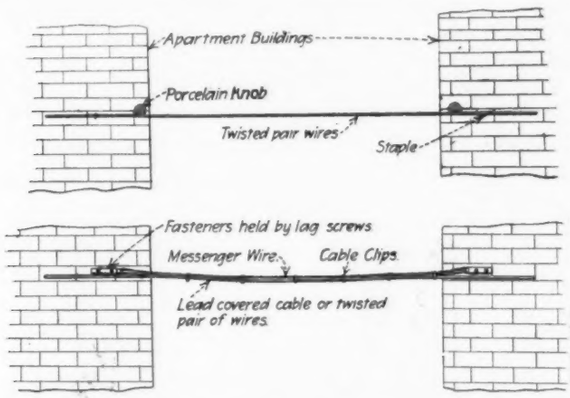
One of the reasons which originally led the company to adopt a non-sales policy was the desire to maintain the friendliness and co-operation of the local electrical supply houses. It was soon found, however, that one or two of the firms nearest the company's store were getting the principal benefit from its display, while the rest of the dealers were not deriving any direct benefit, the indirect benefits being also difficult to trace. Viewed from every standpoint, the company therefore felt that, in order to achieve the greatest results not only for itself but for the entire electrical industry in the territory it serves, there should be inaugurated a vigorous sales policy shaped along progressive business lines.

The matter was taken up with the various electric supply interests, and it was frankly explained that the plan was to continue to co-operate with the supply dealers, as has been done in the past, by maintaining such prices as would give a fair profit to both company and the dealers. Willingness was also expressed to purchase appliances through local jobbers when this could be done on equally advantageous terms. The dealers have viewed the matter broadly and have proffered their continued active co-operation and support as in the past.

Illumination and Wiring

Better Back-Yard Construction in Cities

As the business of supplying telephone and electric service grows and becomes more standard, it is interesting to note the sturdier and more sightly construction which replaces that used in former days. As typical of this gradual change, the methods of installing wiring on building exteriors is shown in the sketch



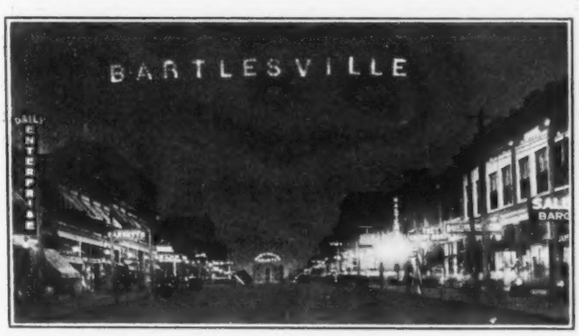
FIGS. 1 AND 2—OLD AND NEW WIRING METHODS

herewith. Formerly telephone wires extending along the rear walls of apartment buildings were held in position by insulating staples and porcelain knobs and sustained their own weight between adjoining structures.

Now, however, under similar conditions, a messenger wire solidly supported is swung between buildings, and the wire, or the small cable which is often used, is suspended by means of cable clips. Both of these schemes present a marked improvement over the older method wherein customers' service wires radiated from a pole top, and it is likely that lighting companies might modify and copy such telephone construction as this for back-yard work in cities.

Sign Lighting at Bartlesville, Okla.

The accompanying illustration shows a night view of the main street of the little city of Bartlesville, Okla., in which the Washington County sign on the

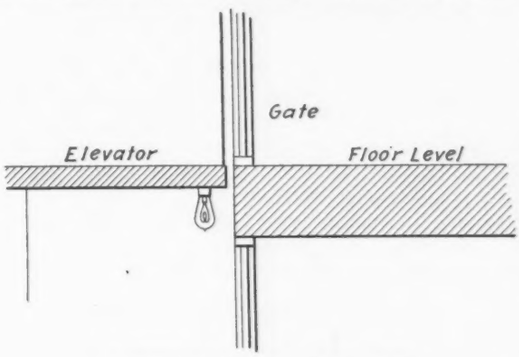


SIGN LIGHTING AT BARTLESVILLE, OKLA.

court house, which the Bartlesville Interurban Railway Company recently erected for the county, is plainly visible. The sign is made of 6-ft. letters and contains 384 10-watt lamps. It is 70 ft. long and 30 ft. high and is connected to the company's dusk-until-midnight flat-rate circuit, the cost being borne by the county. The illustration also shows two and one-half blocks of store buildings on which there are thirty electric signs, all of which have been erected since the Doherty Operating Company took over the property eighteen months ago. Mr. C. W. Johnston is manager of the new-business department of the company.

"Watch-Your-Step" Lamps for Elevator Thresholds

In the Monadnock Block, Chicago, the elevators have been equipped with safety lamps mounted just beneath



SAFETY LAMP FOR ELEVATORS

the car floors in such a way that the thresholds of the stationary gates reached by the car are illuminated as shown in the sketch herewith. The presence of the lighted rectangle warns the passenger to step across the opening between the car floor and the doorsill. If the car is above the level of the floor at which it is stopped the floor itself is lighted, but in any position the reflection of light from the doorsill gives ample warning to the passenger leaving the car. The lamps are operated continuously while the elevators are in service. Each lamp is a 16-cp unit mounted in a wall-type receptacle.

Indirect Lighting for New York Bookstore

The lighting of Scribner's bookstore, New York, is accomplished by straight-filament tungsten lamps placed in cornice recesses on each side of the store. The ceiling is arched, the maximum height being 29

MODERN LIGHTING OF LARGE BOOKSTORE

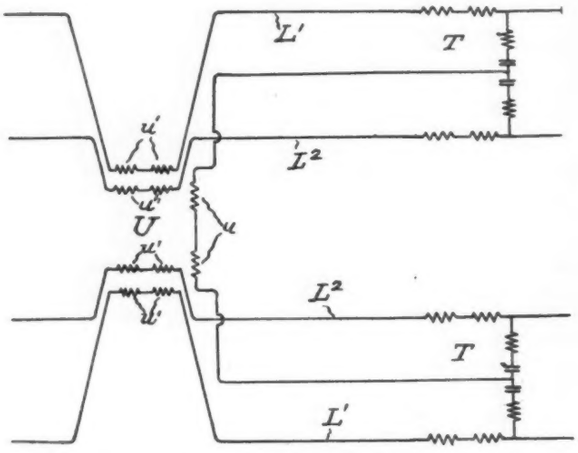
ft. and the height to the base of the arch, or to the caps of the pilasters shown in the accompanying illustration, 22 ft. There are 186 ft. of reflectors, and they extend continuously on the long sides of the store except in the space occupied by the caps of the pilasters. The illumination is provided by 136 35-watt "linolite" lamps. At the rear of the store on the balcony level is

a picture gallery for the display of prints. The cove containing the upward diffusing reflector is also carried across this space. At the front of the store, owing to the metal and glass construction, a recess for the reflector has not been provided; an upward reflector, however, is attached to and made a part of the downward window reflector, and the resulting illumination in the window is considered very even. The lighting and reflecting equipment for this installation was supplied by the H. W. Johns-Manville Company, New York.

RECENT TELEPHONE PATENTS

Improvement in Loaded Lines

The so-called loaded lines—that is, lines provided with distributed inductance to decrease the attenuation—have been in successful use for a number of years. Nevertheless, improvements in the direction of flexibility and of transmission continue to be made. Some time ago means for phantoming such loaded lines were devised, the resulting phantom also being loaded. Now there has been patented a means for reducing the



MEANS FOR REDUCING REFLECTION LOSSES IN DUPLEX CIRCUITS

reflection losses where such a combination of loaded physicals and phantom is connected to a non-loaded or low-impedence circuit such as is used for terminating purposes.

The diagram shows the general plan, L' and L^2 being the loaded physical lines providing the phantom. It will be noted that the windings u are a bridge of the phantom and are of no effect on the physical lines as they are connected to neutral joints. On the other hand, windings u' are connected in the physical circuits. The windings at U are associated upon a toroidal core. Similarly each set of windings at T is upon a toroidal core. The windings in the physical circuits are made up of twisted pairs, and they are laid on the core in such relation to the bridged windings as to obtain the desired results. The coils act in effect as auto-transformers. This invention has been patented by Mr. Thomas Shaw, of Hackensack, N. J., who has assigned his two patents to the American Telephone & Telegraph Company.

Automatic System

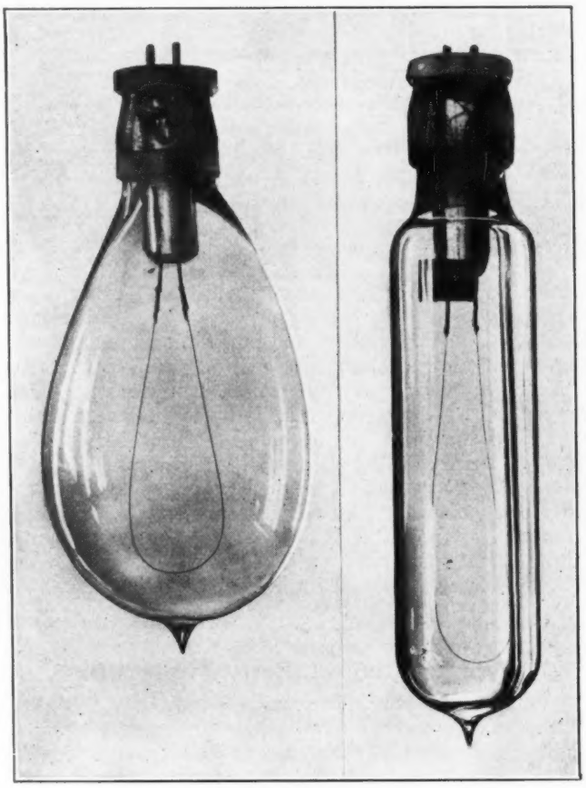
Mr. C. J. Erickson, of Chicago, has patented an automatic system adapted for party-line working. The circuits are arranged to prevent one station on the line from interfering with or knocking down a connection existing to another station on the same line. A locking relay is arranged at each station which operates whenever the hook switch is lifted while a connection already exists to that line. This locking relay prevents the sending of any interfering currents or making interfering contracts during its energization.

Letter to the Editors

Westinghouse "Stopper" Lamp

To the Editors of the Electrical World:

SIRS:—I am sending herewith some correspondence with reference to samples of the old "stopper" lamp. It occurs to me that you might find this sufficiently in-



WESTINGHOUSE "STOPPER" LAMPS OF THE KIND USED AT THE CHICAGO EXPOSITION OF 1893

teresting for notice or publication. The "stopper" lamps were got up by Mr. Westinghouse in order to meet the emergency due to the sustaining of the Edison all-glass-globe patent, and were used for lighting the World's Fair which was held at Chicago in 1893.

CHARLES A. TERRY,
Vice-president Westinghouse Electric & Manufacturing Company.
New York, N. Y.

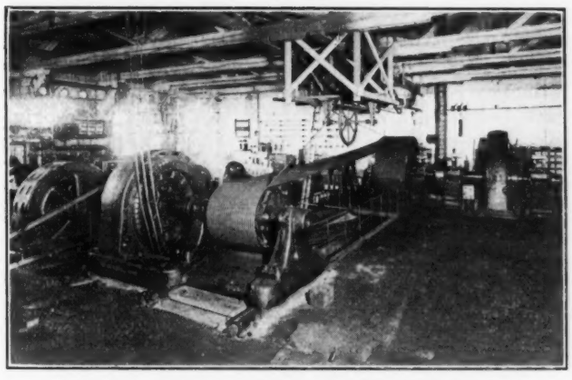
[The letters referred to indicate that the two "stopper lamps" illustrated herewith were recently found among the archives of the law firm of Sheffield, Bentley & Betts, to whom they were submitted by the Westinghouse company in 1892 for an opinion as to whether they infringed the Edison patent No. 223,898. When tested in October, 1914, at Bloomfield, N. J., the two lamps, now more than twenty years old, were found to have retained their vacuum, and although the vacuums could not be termed first-class, yet they are in serviceable condition.—EDS.]

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Rope-Driven Motor-Generator Set

In one of the older steam stations of the Portland Railway, Light & Power Company there were two machines driven by Corliss engines through rope drives. These machines were a 800-kw direct-current generator and a 750-kw alternator. They were not run, owing to the existence of sufficient energy available from hydroelectric plants and modern steam prime movers. Mr. E. D. Searing, in a contribution to the "wrinkles" presented at the recent meeting of the Northwest Electric Light & Power Association, said that when additional energy was required for 600-volt service from the station in which were these machines one of the engines was dismantled and the 750-kw alternator installed in

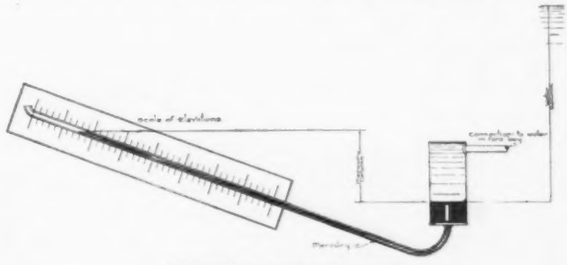


ROPE-DRIVEN MOTOR-GENERATOR SET

its place to act as a motor to drive the 800-kw direct-current generator, thus forming a rope-driven motor-generator set.

Forebay Gage Level

In nearly all hydroelectric stations it is desirable to know the level of the forebay water, or, in the case of pumping stations, the head against which pumps may be working, and in many instances the possession of this information is imperative. A method of accomplishing this purpose was described by Mr. L. J. Pospisill, of the Washington Water Power Company, before the recent meeting of the Northwest Electric Light & Power Association. A column of mercury is arranged to balance the column of water brought in from the forebay to the mercury column through the pipe in which there is no flow. That there should be no flow in this pipe will be obvious when it is considered that only the static head is recorded, and should there be no flow, the velocity head producing such flow would not be registered. It will be noted that since the specific gravity of mercury is about 13.6, a variation of 1 ft. of water level will cause a corresponding variation in the mercury column level of 1 ÷ 13.6, or 0.88 in. This variation is too small to permit of close reading, but if one of the mercury columns be inclined, so as to be on a slope, this variation is then increased to any amount desired, depending on the slope given to the column. Furthermore, if one leg of the mercury column (the one to which the water level is connected) be enlarged so as to form a reservoir, then if the forebay level be in-

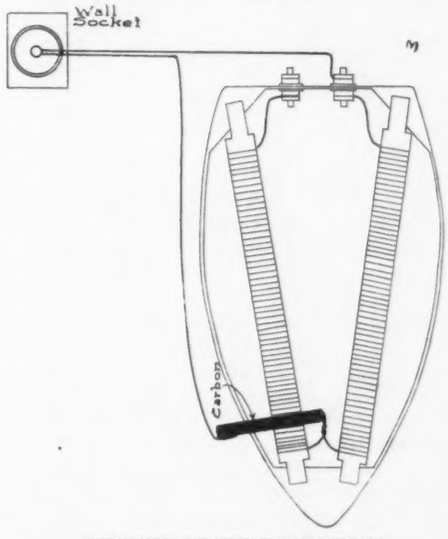


MERCURY FOREBAY GAGE

creased, the drop on that side will be small when it shall have forced enough mercury out into the smaller leg to form the new balance. The inclined leg containing the mercury column should be placed in a glass tube on which a scale suitably marked off as desired in feet or elevations can be placed and readings taken at any time. This scale should be initially calibrated either from actual levels in the forebay or by creating artificial water levels with forebay pipe connections, so that if the diameters of pipes both on the water and gage side as well as the angle of slope of the gage pipe are known the calibrations can be computed.

Welding Small Connections

In making connections, especially in heating devices, subject to high temperatures it is out of the question to use solder, since the temperature reached in the de-



WELDING HEATING ELEMENTS

vice would cause the solder to run. A convenient arrangement for welding connections of flatirons or any other fine wires is shown herewith and was described

by Mr. G. S. Covey in the "wrinkles" presented at the Northwest Electric Light & Power Association. The ends of the wires to be welded are twisted together and the weld is completed by forming an arc, one electrode of which is the twisted connection and the other electrode a piece of carbon. The resistance of the heating unit in the iron shown is sufficient to limit the amount of current flow so that a short-circuit does not result.

Cooling Water Used in Gas-Engine Manifolds

At Independence, Kan., where the central-station operators have had several years' experience with gas engines, they strongly recommend the practice of mixing flowing water with the exhaust flame from the engines in the manifolds. Not only does this plan prevent disastrous explosions in the muffle box but it also saves breakage of manifold pipes caused by expansion and contraction of the metal. At one time Mr. W. R. Murrow, manager of the Independence company, considered plans for heating the engine room with a hot-water system having its heating coils in the exhaust manifolds of the gas engines. But the project was never tried, as it was feared that the fuel saving effected would be more than offset by the damage which might occur from muffle-box explosions and broken manifolds.

Home-Made End-Play Device

The accompanying sketch, contributed by Mr. L. R. Woodcock, of the Washington Water Power Company, to the "wrinkles" presented at the recent meeting of the Northwest Electric Light & Power Association, shows

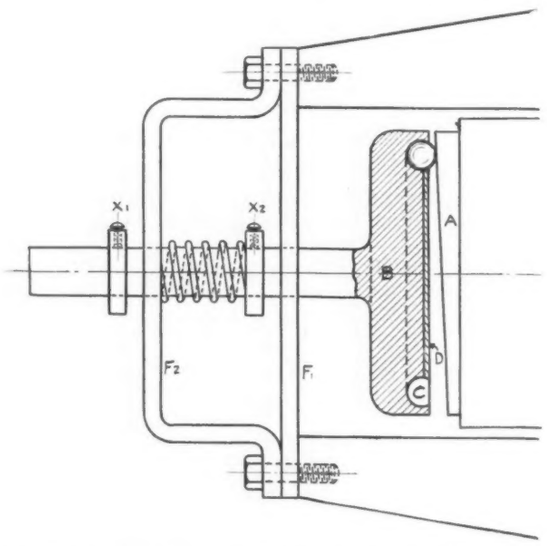


DIAGRAM SHOWING END-PLAY DEVICE OF HOME-MADE MANUFACTURE

a home-made end-play device that was applied to an old Edison bipolar machine and has been in successful operation for nearly two years. A disk of steel *A* is turned up so that its diameter is a little less than the diameter of the shaft of the generator. The thickness of the disk varies from 0.25 in. on one side to 0.5 in. on the other. Holes are drilled in the disk and countersunk, so that when it is screwed on to the end of the shaft there are no projections. The disk is tempered glass-hard. The collar *B* is turned to the same diameter as the disk with a spindle 0.75 in. in diameter and 5 in. long, and in its face is cut a ball-race deep enough to take a 0.5-in. steel ball. A thin plate *D* is fastened to the face of the collar *B* to prevent the ball from falling out, and the spindle passes through the frame F_1 and F_2, which is made of heavy strap iron and attached to the end of the bearing. A heavy spring is placed around the spindle inside the frame, and the locknuts X_1 and X_2 regulate the distance of travel of the spindle and the compression of the spring respectively. When the machine is running the ball is pressed against the end of the shaft by the spring and the revolving shaft tends to carry it round, but on account of the varying thickness of the disk *A* the armature is forced to one side, when the ball gets between the thick part of the disk *A* and the collar *B*. After a short time the armature floats back and is again given another kick sidewise. The spring prevents the action from being too violent and rapid.

Operating Centrifugal Pumps with Variable Delivery

BY A. PETERSON

The delivery of a centrifugal pump increases directly as the speed, while the head developed increases as the square of the speed. Therefore, if the pump is delivering through a purely frictional resistance, so that the head required increases approximately as the square of the delivery, practically constant efficiency will be shown at all deliveries and speeds. If the pump were originally selected to give its maximum efficiency at one given speed and delivery, it will give this maximum efficiency at all other speeds and deliveries. However, if the head is made up partly of static head and partly of frictional head, as in water-works service, this relation is disturbed, and the pump should be selected to give its highest efficiency at the normal head and delivery. It will then give comparatively high efficiency at other usual heads and deliveries, and if the efficiency characteristic is flat, the average efficiency will be high.

It is also feasible to have centrifugal pumps delivering to stand pipes or reservoirs maintain a good efficiency at different rates of deliveries by slightly varying the speed. The steam consumption of a steam turbine increases somewhat at a reduction in speed, although if the turbine normally is operating at its most efficient speed, the increase in steam consumption is very slight. The use of mechanical reduction gears makes it possible so to design the unit that the turbine will operate normally at its most efficient speed, so that wide variations in delivery can be obtained with practically constant duty.

Bracing of Cross-Arms

Which is the correct way to brace cross-arms—to fasten the brace to the front or the back of the arm? If both methods are employed in approved practice, please state the advantages of each. S. R. B.

Both methods of bracing are employed, but to give transverse as well as vertical rigidity to the arm the braces should be attached to the front; that is, the side away from the pole. With an arm braced in this manner there is less opportunity for it to twist when the loads on the pins or on opposite sides of the pole are unbalanced. Longer straps will, of course, be required for the front-attached brace than would be needed if they were fastened to the back of the arm. If transverse flexibility is not objectionable in a cross-arm, it may be braced from the back. The straps will consequently cost less as they do not contain as much material and do not have to be formed.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Large Induction Motors.—G. MOORES.—The conclusion of his long article on some features of mechanical design of large induction motors. In the present instalment the author takes up stator windings, dealing with concentric windings, diamond windings and involute or butterfly windings. Rotor windings are finally considered.—London *Elec. Review*, Oct. 23 and 30, 1914.

Wave and Lap Windings.—In the "Question and Answer" department are discussed the conditions under which it is preferable to employ a wave winding rather than a lap winding for the armature of a four-pole motor.—London *Elec. Eng'ing*, Oct. 29, 1914.

Lamps and Lighting

British Arc-Lamp-Electrode Industry.—A note pointing out that before the war the conditions were such as to enable Germany and Austria to supply electrodes for the British market at prices far lower than those at which they could be manufactured in England with profit. As the British electrode manufacturers fear that these conditions may prevail again, or at all events in a form only modified to a certain extent, after the war, there is a decided disinclination to make large extensions of carbon works on a permanent basis in England, or to establish new ones. Nearly $2,500,000 worth of electrodes were exported from Germany during 1913, more than one-sixth of which were sold in Great Britain. From Austria-Hungary $240,000 worth were exported, of which, however, $107,500 worth were sent to Germany, leaving $132,500 exported to other countries, of which $46,000 went to Great Britain. So long as it is still impossible to manufacture in England sufficient electrodes for that country's own needs, it does not seem likely that it will start competing in foreign markets, unless, on further examination, the British manufacturers come to the conclusion that the increased production will put them in a position to compete with Germany for the export trade after the war is over. Two British companies have started the resumption of carbon manufacture, which they had given up years ago. Also a third small and independent carbon factory has been started.—London *Elec. Eng'ing*, Oct. 29, 1914.

Moving-Lamp Photometer.—C. C. TROWBRIDGE AND W. B. TRUESDELL.—A description of a modification of the ordinary photometer. The essential feature of the apparatus is a sliding carriage supporting one of the lamps, which may be set in to-and-fro motion at uniform velocity in the photometric axis. Comparisons of equal field intensity are observed while the lamp is in motion and are recorded by a simple mechanism. The purpose of the measurements was to ascertain the magnitude of errors occurring in photometric measurements in which one of the light sources is rapidly diminishing in intensity as in the photometry of phosphorescent gases and certain phosphorescent solids. The opinion was held that these errors might be of considerable magnitude, and this view was verified. The use of the moving-lamp device also gives some information on the rôle played by the fatigue of the retina of the eye in photometric measurements in general. The errors in photometric measurements of phosphorescent decays may run as high as 15 per cent or more for rapid decay, and are apparently chiefly due to fatigue of the retina of the eye. The rôle played by the fatigue of the retina in photometry is shown and figures are given for this effect in the case of three persons, showing a marked difference of retinal fatigue.—*Phys. Rev.*, October, 1914.

Installations, Systems and Appliances

British Central Station.—An illustrated description of the new central station in Basingstoke, a British borough of 12,000 inhabitants. There are two 150-hp Diesel engines, coupled to 100-kw, 460-to-500-volt shunt-wound generators of the interpolar type. The plant operates in conjunction with a 300-amp-hour battery. There is also a balancer to deal with 100 amp out-of-balance current and a 42-hp motor-driven booster for battery charging. For distribution use is made of the three-wire system with 460 volts across the outers.—London *Elec. Review*, Oct. 23, 1914.

Circuit-Breakers.—B. H. SMITH.—An illustrated description of a series-transformer tripping device for circuit-breakers.—*Elec. Journal*, November, 1914.

Wires, Wiring and Conduits

Testing High-Tension Cables.—LEON LICHTENSTEIN.—The conclusion of his long illustrated paper on the testing of high-tension cables by direct current. The author describes the Delon portable rectifier plant used by the Siemens & Halske company for this purpose. Tests were made on the break-down voltage of paper-insulated three-phase cables. Six lengths were tested with alternating current and six with direct current. Each test lasted twenty minutes. The break-down emf for alternating-current averaged 50,600 volts and for direct-current 128,000 volts, so that the ratio is 2.53. The investigation is being continued, and the author expresses the hope that the difficulties involved in testing cables after they have been placed in the ground will be greatly reduced by the use of direct current.—*Elek. Zeit.*, Oct. 22, 1914.

Electrophysics and Magnetism

Mechanical Equivalent of Heat.—ROBERT FREUND.—Weber formerly reported on a new method for determining the mechanical equivalent of heat from the heating of a metallic cylinder in a rotating magnetic field. There is a source of error in this method due to the fact that if the rotating field is not exactly circular (that is, if the magnetic vector varies in size while rotating), part of the heat-producing eddy currents do not contribute to the production of the torque. This source of error has been avoided in an arrangement devised by Tuma. The present author has made experiments with this arrangement and gives his results in this paper. The mean value of eight series of tests is 426.25.—*Phys. Zeit.*, Oct. 1, 1914.

Mass and Velocities of the Alpha Particles from Radioactive Substances.—SIR E. RUTHERFORD AND H. ROBINSON.—An account of an accurate determination of the deflection of the alpha rays in a magnetic and electrostatic field of known intensities by the photo-

graphic method. A thin-walled tube filled with emanation was used as a source of alpha rays. The value of E/m—the ratio of the charge to the mass of the alpha particle—was found to be 4820 electromagnetic units. This agrees within the limits of experimental error with the value to be expected from electrochemical data, namely, $E/m = 4826$, supposing that the alpha particle carries two unit charges. The value of E/m for the alpha particle from radium C is identical within experimental error with the corresponding value of the alpha particle from radium A and the radium emanation. The velocity of expulsion of alpha particles from radium C is 1.922×10^{9} cm per second. This is a value about 7 per cent lower than the previously accepted value. By using the known relation between the range of an alpha particle and its velocity the velocities and energies of the expelled alpha particle are calculated for all the known alpha-ray products. The results are given in a table. It is calculated that the heating effect to be ascribed to the kinetic energy of the alpha particles expelled from radium is about 7 per cent smaller than the value experimentally measured. It is consequently concluded that a small part of the heat emission from radium is to be ascribed to causes other than the energy of the expelled alpha particle. No evidence has been found that particles differing in mass or charge from the alpha particle are emitted from an alpha-ray tube.—*Philos. Mag.*, October, 1914.

Electrochemistry and Batteries

Electric Furnace for Brass.—An abstract of a paper by H. G. Dorsey presented before the American Institute of Metals. The Helberger furnace did not prove a success on a commercial scale in the author's brass foundry. In a paper by H. W. Gillett and J. M. Lohr the melting losses in electric brass furnaces were discussed. Their experiments showed that the losses were reduced to one-half or one-third of what they would be in good practice with fuel-fired furnaces. "The advent of the electric furnace in the brass foundry will be slow but sure. However, it will never compete with fuel-fired furnaces where metals are now melted down without loss or with losses of less than 1 per cent. But where, as with many of the non-ferrous metals, the losses in melting are a large factor the electric furnace gives promise of effecting a saving. In fact, the electric furnace in brass melting is no longer a wild hope, but may be regarded as a certainty." A paper by G. H. Clamer and Carl Hering dealt with the use of the pinch-effect furnace for electric brass melting. E. M. Schmelz described an electric-furnace design of the Stassano type, so modified as to be of use for medium temperatures. In a paper by H. M. St. John electric brass melting from the central station viewpoint was discussed.—*Met. and Chem. Eng'ing*, October, 1914.

Industrial Electrochemistry.—F. FOERSTER.—The conclusion of his paper read before the German Association of Electrical Engineers on industrial electrochemistry. In the present instalment the author deals with electric furnace work, especially the refining of steel, the manufacture of ferro-alloys, carborundum, graphite, calcium carbide and cyanamide. He finally refers to the fixation of atmospheric nitrogen and questions the economic soundness of the direct combination of nitrogen and oxygen by means of discharge through air, since the efficiency is as low as 3 per cent. The author assumes that 1,000,000 kw is now used for electrochemical work. Germany has no great water-powers but large lignite deposits. The author urges German capitalists to invest in large water-powers in other countries.—*Elek. Zeit.*, Sept. 24, 1914.

Melting Ferromanganese.—AXEL SAHLIN.—A (British) Iron and Steel Institute paper on the use of liquid ferromanganese in the steel industry and the application of the Rennerfelt electric furnace for melting ferromanganese.—London *Elec. Review*, Oct. 16, 1914.

Storage Battery Charging.—A note on a recent British patent (No. 22,348, 1913) of H. J. Read and W. J. Bransom for a system for interrupting the charging circuit when a storage battery is fully charged. An ampere-hour meter acting through an overbalance mechanism and relays trips the circuit-breaker when a predetermined reading is attained.—London *Elec. Eng'ing*, Oct. 29, 1914.

Units, Measurements and Instruments

Friction Compensation in Ampere-Hour Meters.—W. STRELOW.—One of the special problems of importance in the design of ampere-hour meters is that of overcoming the errors at low load by providing an efficient compensation for friction. For this purpose it is necessary to use an additional force. Fig. 1 shows the arrangement in which an auxiliary shunt current of 3 or 4 milliamp is used. A shunt of an ampere-hour meter for 10 amp is shown at 1, the resistance of 1 being 0.07 ohm. The armature 2 has a resistance of 4 ohms, and the additional resistor 3 has a resistance of 1 ohm, so that at full load of the shunt a current of 0.140 amp passes through the armature of the meter. The meter starts at 1 per cent of full load; that is, for a current of 1.4 milliamp the friction which prevents starting is overcome. According to the curve of the errors of an ampere-hour meter without friction compensation (curve *a* in Fig. 2) the error is —2.5 per cent at 10 per cent full load. It is —5 per cent at 5 per cent full load, and it is —10 per cent at 2.5 per cent of full load. A load of 2.5 per cent corresponds to an armature current of 3.5 milliamp. Since the error at this load is —10 per cent, 0.35 milliamp additional current is necessary to compensate this error. In order to change the error of —10 per cent into one of +10 per cent an additional current of 0.7 milliamp is necessary. This small current must be obtained from the network (220 volts). As shown in the illustration, the series resistor 4 is connected in an adjustable manner to some point in the resistor 3. The resistance of the series resistor 4 is 63,000 ohms for a voltage of 220, so that the current in it is 3.5 milliamp. The resistances of the armature (4 ohms) and shunt 1 (0.07 ohm) and additional resistor 3 (1 ohm) are such that when the end of the resistor 4 is connected to that end of resistor 3 which is near shunt 1 there are in parallel 5 ohms and 0.07 ohm, while if the connection is made to that end of the resistor 3 which is near the armature 2 there are in parallel 4 ohms and 1.07 ohms. In the first case an additional current of 0.07 milliamp and in the second case an additional current of 0.7 milliamp is obtained which flows through the armature. An additional arma-

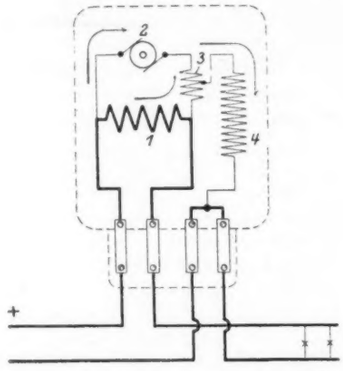


FIG. 1—WIRING ARRANGEMENT OF AMPERE-HOUR METER

ture current of 0.07 milliamp reduces the error from — 10 per cent to — 8 per cent, while an additional current of 0.7 milliamp produces an error of + 10 cent and the curve of errors is then represented by curve *b*. Finally, if connection of the resistor 4 is made to the

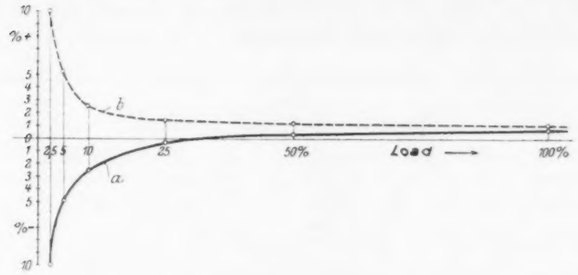


FIG. 2—ERRORS OF AMPERE-HOUR METER WITHOUT FRICTION COMPENSATION

central point of the resistor 3, so that the additional current is 0.35 milliamp, the curve *a* is raised by 10 per cent at 2.5 per cent full load, by 5 per cent at 5 per cent full load, by 2.5 per cent at 10 per cent full load, so that the ampere-hour meter gives correct readings from 2.5 per cent of full load upward (Fig. 3). Without additional current the ampere-hour meter starts at 1 per cent full load (1.4 milliamp), and with the additional current of 0.7 milliamp it starts at 0.5 per cent of full load. Even if the voltage in the network should rise by 20 per cent, there would not be any danger

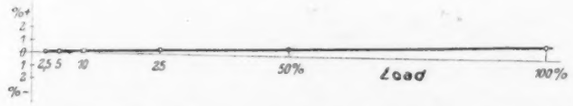


FIG. 3—ERRORS OF COMPENSATED AMPERE-HOUR METER

that the meter would run unloaded since the additional current is only 0.84 milliamp, while 1.4 milliamp is required for starting. This construction is used for instance, in double meters for three-wire installations, a shunt and an armature being placed in each outer conductor. Such a meter for 2 × 10 amp and 2 × 220 volts—that is, 4400 watts—begins to register at 11 watts (that is, at 0.25 per cent of the full load) and gives correct readings from 50 watts upward. The power consumption of the friction compensation is 1.8 watts.—*Elek. Zeit.*, Sept. 24, 1914.

Testing of Potentiometers.—FRANK WENNER AND ERNEST WEIBEL.—For precise measurements with a potentiometer the errors in the adjustment of the resistance sections or coils in the apparatus must be known. These errors can be determined by measurements of the resistances of the various sections, but without some systematic method of applying corrections they are not easily allowed for in the use of the potentiometer. It is convenient to express the relation between the known electromotive force, the unknown electromotive force, the readings and the corrections by the formula $E = f[(e_1 + a_1) + (e_2 + a_2) + \text{etc.}](1 + b + c + d)$, where E is the value of the unknown electromotive force, f is the range of readings, e_1 is the reading of the highest dial, e_2 is the reading of the next highest dial, etc. $c = (S - 2) \div s$, where S is the value of the known electromotive force, and s is the reading of the known electromotive force dial or dials, and b, d, a_1 and a_2, etc., are small corrections due to errors in the adjustment of the various resistance sections. The correction a_1 depends only on the reading e_1, a_2 depends only on the reading e_2, etc., b depends only upon the reading s, and d depends only upon f. A table can therefore be constructed for each dial giving the corrections corresponding to each of its possible readings. Let R_e be the resistance in the potentiometer between the E-terminals and R_s that between the S-terminals. Then, if the total current is independent of the settings of the various switches or plugs, $E = SR_e/R_s = f[(e_1 + a_1) + (e_2 + a_1) + \text{etc.}](1 + b + c + d)$. Thus, if R_e/R_s is determined for the various readings of f, of e and of s, the corrections b, d, a_1, a_2, etc., can be determined. In order to reduce the time required for making the measurements and to obtain the data in such form that the corrections can be more easily calculated, a special piece of apparatus was constructed and has been in use during the past two years. This apparatus, which is called a ratio set, furnishes a rapid and direct means for calibrating all types of potentiometers which have so far been submitted to the Bureau of Standards for test. It is equivalent to 211,110 resistance sections of 0.01 ohm each, connected in series and so arranged that a branch connection (either to battery or galvanometer) can be made between any two adjacent sections; or it is equivalent to a slide wire on which contact can be made at 211,110 points. The apparatus is made of 100 resistance sections, twenty of each of the following denominations: 100 ohms, 10 ohms, 1 ohm, 0.1 ohm, and 0.01 ohm. Five dial switches serve to shift the resistance sections from one side to the other of the branch connection, or to cut out sections on one side and insert corresponding sections into the other side. In use the ratio set is connected in parallel with the potentiometer to be tested in such a way as to form two arms of a bridge, while the potentiometer forms the other two arms. This arrangement constitutes a Matthiessen and Hockin bridge. The ratio set is adjusted so that a balance of the bridge is obtained for each setting of the dials of the potentiometer for which corrections are desired. The corresponding readings of the ratio set (when connected for known errors in its resistance sections) give data from which the corrections b, e, a_1, a_2, etc., of equation (1) can be calculated. Certain adjustments are made so that the corrections are obtained almost directly from readings of the potentiometer and ratio set.—*Scientific Papers, Bureau of Standards*, No. 223.

Book Review

PROCEEDINGS OF THE TWENTY-FIFTH ANNUAL CONVENTION OF THE NATIONAL ASSOCIATION OF RAILWAY COMMISSIONERS. New York: Law Reporting Company. 612 pages. Price, $1.

The proceedings of the association, which consists of members of public service and railroad commissions of the various states and of the Interstate Commerce Commission, are important. The association meets annually and in a convention lasting for several days discusses many subjects which concern commissions and the corporations over which they have jurisdiction. While in the beginning the affairs of the association were devoted entirely to the steam railroads, the development of public service commissions later and the extension of jurisdiction to other classes of public utilities led to a change in the character of the program. The proceedings now are devoted in part to the affairs of other classes of public utilities and in part to the large questions of capitalization, rate of return, etc., which concern all classes of public service corporations equally. The proceedings show the tendencies in commission control and thought and contain much of interest to central-station companies and electrical concerns.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

Fixture Studs

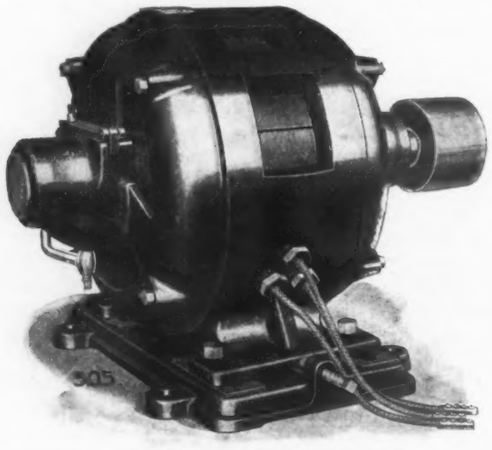
Sherardized stamped-steel fixture studs have recently been placed on the market by the National Metal Molding Company, Pittsburgh, Pa. The thickness of the metal (No. 11 B. & S. gage) is sufficient for tapping the hollow stems of the male studs to convert them into

MALE FIXTURE STUD

female studs and for threading the female studs in case it is desired to change them to male studs. The studs are so shaped that the stems can be passed through the center knock-out holes of outlet boxes, thus insuring stability for heavy fixtures.

Polyphase Induction Motor

Alternating-current motors designed for two-phase and three-phase service and built in sizes rated at from 0.25 hp to 7.5 hp have recently been developed by the Robbins & Myers Company, Springfield, Ohio. A cast-iron skeleton-type shell supports the stator. The end heads are cast separately from the frame and are machined to fit the frame. Soft-annealed-steel laminations held together by bolts are used in forming the stator. The rotor is of the squirrel-cage type, with a core built



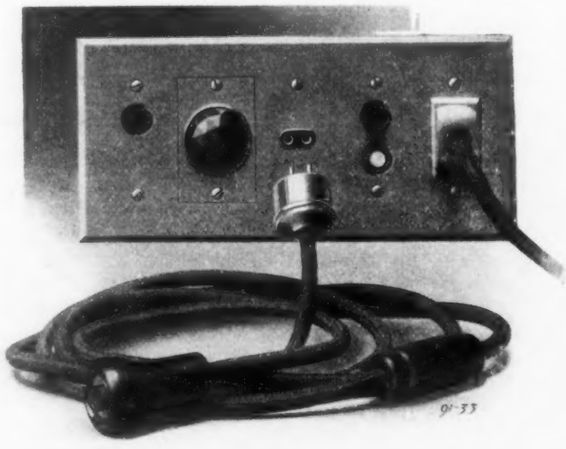
POLYPHASE MOTOR WITH SQUIRREL-CAGE ROTOR

up of steel laminations keyed to a cast-iron spider. The rotor bars are connected to the end rings, which are recessed to fit them, by double-riveting and soldering. Bushed holes are provided in the frame for bringing out the terminals. The motors are equipped with sliding bases and cast-iron pulleys and also idler-pulley attachments or back gears if so desired.

Silent-Call Signal System

A lamp-signal system for use in hospitals has been developed by the Bryant Electric Company, Bridgeport, Conn. By pressing a push-button at the bed incandescent lamps are lighted simultaneously at various points —outside the room or ward door, at the nurse's desk, in the diet kitchen, or elsewhere if desired. All the signal lamps incident to a given call remain lighted and cannot be changed until reset by the attendant at the calling station by the bedside where the call originated.

At the head of the bed or any other convenient point is installed the calling apparatus, which operates on the regular lighting circuit. In the accompanying illustration is shown a ward calling station equipped for sending signals of two kinds and for furnishing connection to portable electric devices. From the center of the calling-station plate a flexible cord, equipped with a special push-button, extends to the bed within reach of the patient. By pressing this button the red bull's-eye shown at the left of the extension is illuminated. The lamp in the corridor over the door and the other



WARD CALLING STATION

lamps connected to the circuit are also lighted at the same time. Still another lamp may be in an annunciator in the head nurse's room to indicate the number of the room from which the call originated. Upon reaching the patient the nurse releases the signal by pushing the control-switch button shown on the extreme left of the calling-station plate. By no other means can the signal be canceled.

The two-button switch at the right of the bed-cord extension may be used by the nurse to call a doctor or an assistant without leaving the patient. At the extreme right of the calling-station plate is a receptacle into which may be inserted a plug and cord extension for use with an examination lamp, reading lamp, electric fan, heating pad, or any other portable electric device. An interesting auxiliary of this system is an elapsed-time recorder which provides a graphic record of the time between the origin of call and the registration of a response.

Electric Percolator Which Cannot Overheat

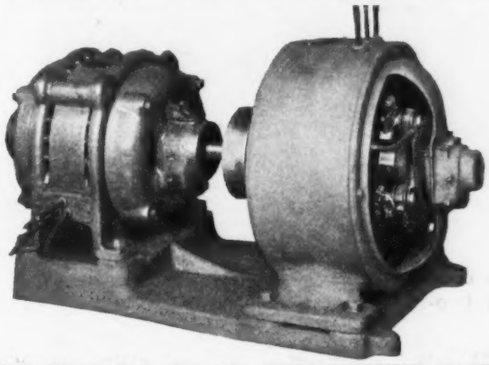
Some electric percolators have been found unsatisfactory because the heating unit burned out when there was no liquid in the pot. This objectionable feature has been avoided in the percolator shown in the accompanying illustration by equipping it with a fuse nut which will open the circuit if the pot is emptied. It is

PERCOLATOR WITH AUTOMATIC CIBCUIT-BREAKER

declared that the appliance will percolate in less than one minute. It will hold three pints and is made of heavy copper which is nickel-plated. A positive-action percolator valve is employed which can be easily cleaned if it becomes clogged with coffee grounds. The device is manufactured by the Simplex Electric Heating Company, Cambridge, Mass.

Motor-Generator Set for Motion-Picture Apparatus

A motor-generator set designed to operate on standard-voltage alternating current and to deliver direct-current energy at the proper voltage for the operation of the arc lamp of motion-picture projecting machines is being made by the Fort Wayne Electric Works of the General Electric Company, Fort Wayne, Ind. No resistance is placed between the generator and the lamp. The switchboard is made up in the form of a steel cabinet and contains the voltmeter and ammeter in the front and the field rheostat which is mounted on the back of the panel with the hand wheel showing in the front. All wires enter the cabinet through conduits. When the "compensarc," as the set is called, is used with two motion-picture machines the cabinet is equipped with a change-over switch. By means of this switch it

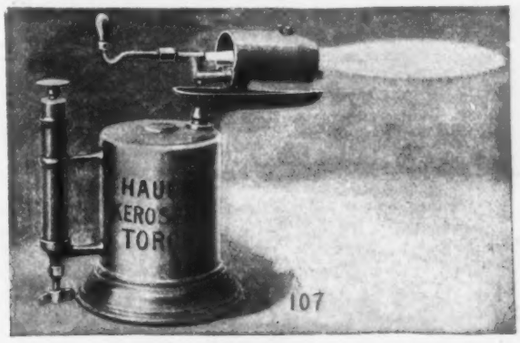


MOTOR-GENERATOR SET FOR MOTION-PICTURE MACHINE

is possible to warm the second lamp on direct current without interfering with the operation of the first arc lamp, and then when the projection of the first reel is finished to start the second immediately with the other machine. The motor-generator set is made in two sizes, one for the operation of a single lamp and the other for two lamps used alternately.

Lineman's Kerosene Torch

A kerosene torch for brazing and sweating wires and cables, etc., has recently been developed by the Hauck Manufacturing Company, 140 Livingston Street, Brooklyn, N. Y. The tank holds 1 quart, and with a full flame

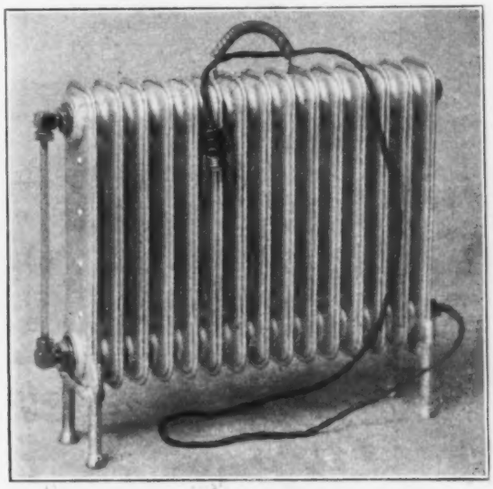


KEROSENE TORCH FOR LINEMEN

0.5 pint of fuel is used an hour. The full flame is 8 in. long. The size of the flame is regulated by a needle valve. The burner can easily be taken apart for cleansing purposes. The weight of the apparatus complete is 5 lb.

Electric Steam Radiator

Illustrated herewith is a fifteen-section electric steam radiator which in appearance resembles the ordinary steam radiator operating from a central-boiler system. In the bottom waterway of the radiator is placed a tube in which is inserted another tube with a diameter 3/16 in. smaller than that of the larger tube. A resistance coil is placed in the smaller tube. From 1.5 quarts to 3 quarts of water are kept in the radiator. The water passes around the smaller tube through the larger one and is heated, about fifteen minutes being required for it to boil. It is necessary to renew the water every three months or so. Radiators of this type weigh from 30 lb.



ELECTRIC STEAM HEATER

to 80 lb., according to size, and, of course, are portable. An automatic device is provided with the heater for the purpose of regulating the temperature according to the degree of heat desired.

This electric heater is being placed on the market by the Electrical Steam Radiator Company, 644 Congress Street, Portland, Me.

Rotary Air Compressor

A rotary air compressor in which the rotor and case of the machine both revolve at the same speed around separate centers was exhibited recently for the first time at the Allied Foundrymen's Association convention in Chicago. As the rotor and case revolve eight pockets between the rotor and the case, formed by rotor vanes

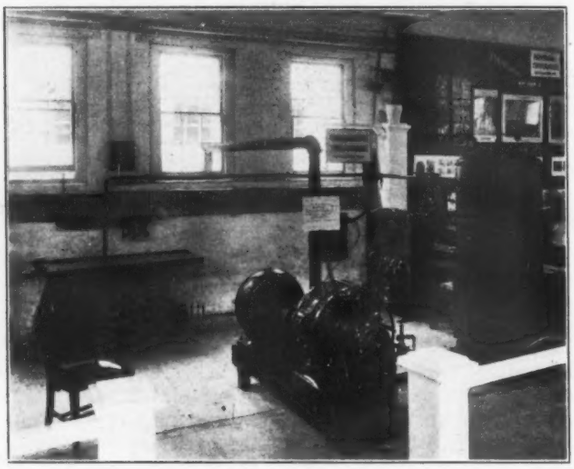


FIG. 1—ROTARY AIR COMPRESSOR AT FOUNDRYMEN'S SHOW

sliding in and out of radial slots in the case, alternately draw air in, compress it and discharge it through the hollow shaft. Each pocket is served by an inlet and outpoppet valve, the inlet valves being mechanically operated. The valve openings lead through chambers in the rotor to the inlet and discharge ends of the hollow shaft. Owing to the fanning action created by rotation of the case and on account of its large radiating area, it is unnecessary to provide water for cooling purposes. Because of the extremely small clearances and the slow movement of the sliding valve vanes, low power consumption and high efficiency are claimed for this appa-

FIG. 2—SLIDING VANES AND AIR POCKETS

ratus, in addition to the qualities of compactness and tightness.

The machine exhibited weighs 1400 lb., occupies a floor space 46 in. by 28 in., is 35 in. high, and is able to deliver air at 275 deg. Fahr. when actually discharging 70 cu. ft. of free air a minute, against a pressure of 100 lb. per sq. in. The compressor is designed for direct motor connection or belt drive. The Wernicke-Hatcher Pump Company, of Grand Rapids, Mich., has developed and is marketing this machine. Some of the units are now in use among building contractors and in industrial plants, and all are said to be giving good service and marked satisfaction on account of the ease with which the compressor and its driving motor can be moved.

Insulated Canopies

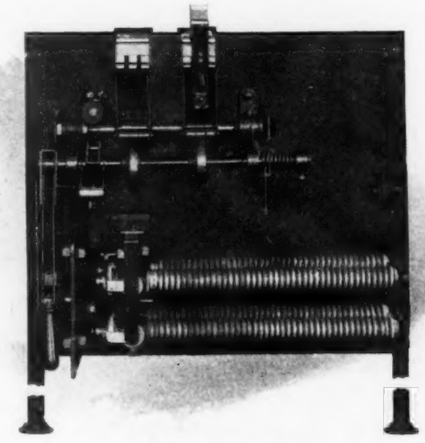
The canopies shown in the accompanying illustrations may be equipped with rings or hooks, as shown in Fig. 2, and they may be used with indirect, semi-indirect or pendent fixtures, arranged singly or otherwise. The canopy is of brass and is heavily reinforced for drilling

FIGS. 1 AND 2—BRASS CANOPIES

and tapping a number of outlets. It is made in two parts which are joined together by an insulating ring. A heavy steel plate is provided which is punched so as to be attached to any outlet box or ordinary metal, wood or plaster ceiling. The canopies are being made by the F. W. Wakefield Brass Company, Vermilion, Ohio.

Starting Rheostat for Large-Sized Direct-Current Motors

Resistance starters of the graphite-compression type, designed for direct-current motors rated at 150 hp to 300 hp, have recently been placed on the market by the Allen-Bradley Company, Milwaukee, Wis. All the oper-



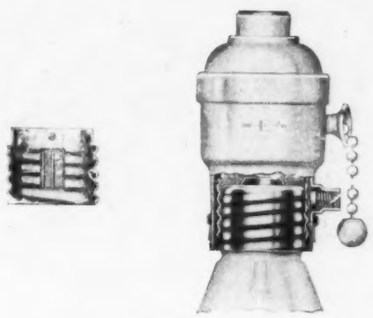
STARTING RHEOSTAT

ating parts are easily accessible, and there is nothing on the back of the panel excepting the busbars and line and motor connections. Only one operating lever is employed. This lever, by means of a cam arrangement, successively actuates two clapper switches, one of which closes the motor circuit while the other shunts the re-

sistance units out of the circuit after they have been fully compressed. The first clapper switch is equipped with auxiliary graphite arcing contacts. An automatic no-voltage release having its operating magnet connected in series with the shunt motor field and an overload release mechanism are also provided. In case field rheostats are used, instead of a no-voltage release, a relay system which short-circuits the field rheostat during the starting period is employed.

Lock Socket

A locking device called the "arrolock" has been developed by the Arrow Electric Company, Hartford, Conn., for use with its brass-shell sockets. The device consists of a small set-screw which is placed against a

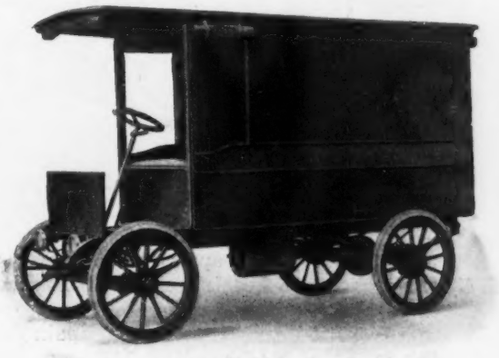


FIGS. 1 AND 2—CROSS-SECTION OF SCREW SHELL AND SOCKET

serrated, hardened-steel clamping piece which engages with the lamp base. A special key is used to operate the set-screw. The set-screw is insulated by the socket lining, which is between the screw and the clamping piece. In Fig. 1 is shown a cross-section of a screw shell and the serrated clamping piece which holds the lamp base in place. A cross-section of a socket with a locking device is shown in Fig. 2.

Light-Weight Electric Delivery Vehicle

A low-priced 750-lb. electric delivery truck has recently been developed by the Ward Motor Vehicle Com-



750-LB. ELECTRIC DELIVERY TRUCK

pany, 101 Park Avenue, New York. The truck, which is shown herewith, is equipped with Timken axles, Westinghouse motor, shaft drive, wheel steer with column control and artillery-type wheels. The tires are 32 in. by 2.5 in. The truck is designed to operate 35 miles to 45 miles on one charge.

Bell-Ringing and Toy Transformers

A small transformer for operating bells, buzzers, annunciators, spark coils for gas-engine ignition, etc., from an ordinary 110-volt, sixty-cycle lighting circuit is shown in Fig. 1. The windings are so arranged that the secondary terminals may be short-circuited without injury. The coils are inclosed in a cast-iron case and are sealed with a heat-resisting, moisture-proof compound. The case is mounted on a slate base. The primary terminals are 6-in. flexible leads brought out through porcelain bushings; the secondary terminals are of the binding-post type. The transformer is made in three sizes—one having two secondary terminals designed for a pressure of 8 volts, another with three secondary terminals designed for pressures of 6 volts, 8 volts and 14 volts, and another with three secondary terminals designed for pressures of 6 volts, 12 volts and 18 volts.

The toy transformer shown in Fig. 2 is designed to reduce the line voltage to a suitable value for operating small motors, cars, lamps, etc. The secondary winding is so designed that the voltage can be varied in steps of

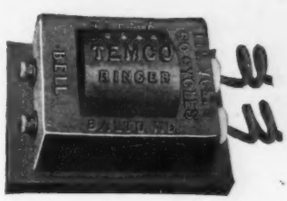


FIG. 1 — BELL-RINGING TRANSFORMER

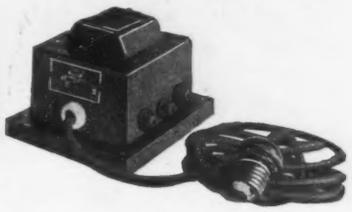


FIG. 2—TOY TRANSFORMER

one volt. The secondary terminals are of the binding-post type. The toy transformer is made in three sizes.

The transformers described above are the product of the Electric Manufacturing Company, 2046 Harlem Avenue, Baltimore, Md.

Kitchen Table with Electric Plate-Warmers

The kitchen table shown herewith is equipped with an electric plate-warming compartment. A three-heat switch and a pilot lamp are also provided. The facings

TABLE WITH ELECTRIC PLATE-WARMING COMPARTMENT

are of Russia iron, and the remainder of the table may be of steel, German silver or monel metal. The table is built in sizes ranging from 4 ft. long up and is fitted with drawers and shelves for pots, pans, etc. The table is being manufactured by Wells, Mowbray & Newman, Inc., 125 West Forty-second Street, New York.

Jobber, Dealer and Contractor

FREE ADVERTISING LITERATURE

Attractive Booklets, Posters, Window Displays, and Advertising Copy, Available for Christmas Business Building

BY A. J. EDGELL.*

"Something for nothing." Something for nothing and no strings on it. How many men will pass up such a proposition? It is safe to say that few would acknowledge such a tendency. And yet every dealer in electric merchandise has this offer put to him by the manufacturers, and rare indeed is the man who is taking full advantage of the large expenditures being made for his benefit in the many selling helps that are his for the asking.

FIG. 1—ATTRACTIVE BOOKLETS ON ELECTRICAL SUBJECTS

Co-operation—that is what the manufacturer is up to. He advertises his goods for mutual benefit. In exploiting his product he spends thousands of dollars, and while he gets the benefit indirectly, the distributer reaps an enormous benefit from the easy sale of the goods advertised. For the success of his campaign he needs the retailer's co-operation.

A device well advertised is half sold. Much of the other half of the selling lies in letting the people know where they can get the advertised article. That is the work of the advertising helps that are furnished gratis.

Baby
For the Wife
The wife desires to give her husband the best of everything—a
G-E Electric
Coffee Pot
will help her to give him the best coffee that can possibly be made.
Mortised for Dealer's Name

FIG. 2—CHRISTMAS PLACARDS ON HEATING DEVICES

It's not enough to stock the appliances. There is a decided difference between keeping electrical merchandise and selling it. Some dealers keep appliances just as if they loved them so dearly that it would pain them to part with them.

"Silence is golden" was never intended as a motto for a business man. If he wants to do a retail business he must make a noise. Whether he pays for all of it or lets the manufacturer pay for a part depends on his willingness to co-operate. Nearly every manufacturer whether large or small furnishes some ready-made advertising matter, and the best thing a dealer can do is to plan his own advertising to link up with the big noise made by the manufacturer.

*Society for Electrical Development, Inc.

Real, live advertising men who are keen in their hunt for ideas that will help increase the dealer's sales and build him more profitable business prepare these helps. By experience these men have learned what to eliminate, what to say, what to suggest, how to attract attention, how to interest, convince and compel action. These men know instead of guessing.

Like certain nationally advertised products, these selling helps come in fifty-seven varieties, or nearly that many.

Christmas Morn
Five Xmas Suggestions
Gifts That Add Beauty to the Home
Make your first shopping trip to our show rooms. Come and see the variety of beautiful and useful gifts.
Westinghouse Electric Ware
Chafing Dishes, Coffee Percolators, Tea Samovars, Irons, Radiators, Milk Warmers, Heating Pads, and many more.
All are useful, perfectly safe, and very economical to operate. No better Christmas gifts can be found. Pay us a call while shopping.
(Dealer's Name Here)

FIGS. 3 AND 4—SUGGESTIVE CHRISTMAS ADVERTISING

There are cuts, big, little and medium-sized, for small announcements or big spreads, with human-interest illustrations, and pictures of the devices themselves. Some have the reading matter prepared for inserting the dealer's name—the only step necessary for the printer to take. No brain-taxing attempt of the amateur is required to get up something to fill the space in the newspaper. The "ad" is there ready for use. It has the punch that will get results.

Window display suggestions are to be had—sometimes photos of displays, sometimes sketches, and at other times only a description—but the idea is there—some of the material needed to place the display, a few well-worded window cards, or more than likely it is material that will serve to attract attention to the display or enhance its appearance. Descriptive cards for the store interior, silent salesmen who convey their message to the customer, are ready, too.

Handsome posters printed in colors on materials ranging from cardboard to tin provide effective display in the window or store interior.

Booklets, many of them works of art, for mailing or distribution in the store, will do missionary work in the home where the "prospect" has leisure to read them.

Return postal cards with the printing done, even to the return address, are furnished sometimes. A postage stamp is the extent of the dealer's investment for these business emissaries.

There are street-car cards to attract the eye of the shopper on the way down town, at the time when she is looking for suggestions; posters for billboard advertising, lantern slides for "movie" theaters, and so on. If that sort of service is not co-operation, what is?

FIG. 5—ELECTRIC YULETIDE LITERATURE

FIG. 6—SANTA CLAUS AS AN ELECTRICAL-SUPPLY MAN

There is no better time to use these materials than right now, when the race for Christmas business is rounding into the home stretch. It is a good habit to get. It's a mighty comfortable sort of feeling, that of knowing one has a high-salaried advertising manager to prepare his campaigns. He pays Uncle Sam 2 cents and receives his ready-to-use material by return mail.

That's co-operation and service.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

New Building for Supply Company.—The Electric Supply Company, Memphis, Tenn., has constructed a new fireproof building. Outside of the front doors and a small amount of shelving no wood has been used.

Substation Equipment for St. Louis Electric Company.—Recently nine General Electric induction regulators were installed in the Morgan Street substation of the Union Electric Light & Power Company, St. Louis, Mo., to replace the old hand-operated boosters.

Electrical Equipment for Snow-Plow Service.—The Boston Elevated Railway Company has placed an order with the Westinghouse Electric & Manufacturing Company for eight motors and control equipment for use on two new snow plows which are being built by this company, and which will be ready for the winter season.

Special Christmas-Tree Lamps.—It has been said that there is a shortage of small incandescent lamps for trimming Christmas trees on account of the European war, but a number of companies, including the Anglo-American Company, 717 New Grant Street, Pittsburgh, Pa., find that this is not the case. The above company has on hand a large number of 14-volt lamps in the form of birds, animals, fruit, etc.

Jeffersonville, Ind., to Purchase Energy from Louisville.—The United Gas & Electric Company, of Jeffersonville, Ind., has closed a long-term contract with the Louisville (Ky.) Gas & Electric Company for the purchase of 1500 kw of electric power for distribution in Jeffersonville. A line has been completed between the two cities, and by the arrangement of purchasing power the Jeffersonville company will be saved considerable investment in additional power-plant rating.

Orders for Turbo-Generator Sets.—Last fall the Mountain Ice Company installed a 375-kva turbo-generator outfit in its natural-ice storage plant at Lake Hopatcong, N. J., for generating energy for lighting and motors. Recently the ice company ordered a 219-kva set for its plant at Gouldsboro, Pa. These sets were furnished by the Terry Steam Turbine Company, Hartford, Conn. The Excelsior Needle Company has also installed a 375-kva Terry turbo-generator outfit in its factory at Torrington, Conn.

Progress of the United States from 1800 to 1914.—An epitomized record of the nation's growth in area, population and resources is contained in a pamphlet just issued by the Department of Commerce through its Bureau of Foreign and Domestic Commerce, entitled "Statistical Record of the Progress of the United States, 1800-1914." In all cases where the statistical data permit the tables cover more than a century, but the later inauguration of certain lines of statistics necessarily restricts in those cases the period covered.

Westinghouse Lamp Company Acquires Milwaukee Factory.—The Westinghouse Lamp Company has purchased from the Kissel-Kar Company of Milwaukee five large buildings along the tracks of the Chicago, Milwaukee & St. Paul Railroad, Milwaukee, which since March of this year it has been equipping with machinery for the manufacture of 600,000 lamps per month. Installation of this machinery is now completed, although the new factory will not begin operation until after the first of the year, it was announced at the office of Mr. Irving Cary, local manager for the company.

Large Demand for Portable-Lamp Fixtures.—The Wallace Novelty Company, 18 East Forty-first Street, New York, recently placed on the market a low-priced collapsible portable lighting fixture, consisting of the base, socket and connector cord and shade. The base and shade can be clamped together so that it takes up a very small amount of space. The device is particularly popular with travelers. Within a short period the output of the above company's factory has jumped from fifty fixtures to 1200 fixtures a day, and according to Mr. C. L. Waterbury, of the Wallace company, it is almost impossible to fill promptly all the orders being received.

Electrical Exports of the United States.—The government has just released statistics on the electrical exports of the country for the year ended June 30, 1914. These are published in tabular form on the page opposite. It is of interest to note that North America absorbs the largest number of batteries; Asia the greatest value in dynamos, with North America second; South America the largest quantity of fans, with Asia second, while North America takes most of the insulated wire exported as well as interior-wiring supplies. The great bulk of lamps of all kinds, motors, transformers, telephones, etc., also find their way to Canada, Mexico and other North American countries, with Asia second in motor demand, Europe first in transformers and South America second in telegraph and telephone instruments.

Electric Sterilizer for Hospitals.—Several electric heaters of the universal type for use with sterilizing apparatus, particularly pressure sterilizers, have been developed by the American Sterilizer Company, Erie, Pa. An installation of this company's equipment has recently been made in the Mount St. Mary's Hospital, Niagara Falls, N. Y. In one room of this hospital there is a battery of sterilizers with a total rating of 60 kw. During the past summer orders for electric sterilizing equipment with a total rating of 183 kw have been received by the above company. Electric installations have been made in more than sixty institutions throughout the United States, Canada and Mexico within the past three years, including apparatus for several army posts and the battleship *Pennsylvania*.

Recent Contracts of the Brooklyn Edison Company.—The Edison Electric Illuminating Company of Brooklyn finds that during periods of industrial depression manufacturers are in a receptive mood and will entertain any proposition which results in lessening production costs. Mr. T. I. Jones, general sales agent of the company, reports recent power contracts as follows: A. D. Matthews & Sons, Inc., department store, 300 hp, displacing isolated plant; Austin-Nichols & Company, 600-hp, centralized plant, displacing five isolated plants; Keeney Theater, 100 kw; Keith's Theater, 125 kw; Flinn-O'Rourke Company, East River tunnel construction, contract for three and one-half years, 7500 kw, involving the taking over of a $120,000 steam plant; long-term contract with the Bush Terminal Company for approximately 10,000,000 kw-hr. yearly on a connected load of 4000 kw.

Good Demand for Stage-Lamp Dimmers.—The Ward Leonard Electric Company, Bronxville, N. Y., has recently developed a 110-step dimming device for tungsten stage lamps. The demand for these devices is quite large. The following are some of the theaters in which these devices have been installed: Garden Theater, Elizabeth, N. J.; DuPont Theater, Germantown Theater, Philadelphia, Pa.; Pantages Theater, Winnipeg, Can.; Gotham Theater, New York; Gayety Theater, Buffalo, N. Y.; John Cort Theater, Boston, Mass.; Dyckman Street Theater, New York; Majestic Theater, Newark, N. J.; Strand Theater, Newark, N. J.; American Theater, Chicago, Ill.; Globe Theater, Philadelphia, Pa.; New Pantages Theater, Victoria, B. C.; Hart House, Toronto, Can.; Prospect Theater, Brooklyn, N. Y.; Madison Theater, Brooklyn, N. Y.; Flatbush Theater, Brooklyn, N. Y.; Crotona Theater, New York; Cort Theater, New York; Brownsville Theater, Brooklyn. N. Y.; West End Theater, New York; Proctor's Theater, Troy, N. Y., and Globe Theater, Baltimore, Md.

EXPORTS OF DOMESTIC MERCHANDISE FROM THE UNITED STATES, BY ARTICLES AND COUNTRIES, DURING THE YEAR ENDED JUNE 30, 1914

Countries to Which Exported	Electrical Machinery, Appliances, and Instruments																
	Batteries	Dynamos or Generators	Fans		Insulated Wire and Cables	Interior Wiring Supplies, etc., Including Fixtures	Lamps						Motors	Static Transformers	Telegraph Instruments (Including Wireless Apparatus)	Telephones	All Other
							Arc		Incandescent								
									Carbon Filament		Metal Filament						
			No.				No.		No.		No.						
Austria-Hungary	$210	$1,186											$3,433	$21		$673	$6,647
Azores, Madeira Isl.																	21
Belgium	7,044	926	4	$65	$1,095		109	$1,524	62,245	$7,083	2,400	$728	11,090		$3,142	23,898	200,827
Bulgaria																	7
Denmark	809				783								1,887		240	1,254	5,081
Finland	719	883			45								2,549				9,239
France	6,074	9,390			1,784	$454			3,300	552	5,625	1,764	182,914	32,311		15,847	126,757
Germany	15,398	30,279	42	548	344	4,903	16	181	21,100	2,320	1,471	246	27,996	1,910	5,000	5,683	146,079
Gibraltar																	8
Greece	194		114	1,218									1,989				1,360
Italy	8,545	8,913			6,359		32	655	2,400	228	3,608	829	47,798	31,939			135,012
Malta, Gozo, etc.		108											25				59
Netherlands	1,217	451			170	70	20	228			710	185	2,514	273		213	6,809
Norway	4,387	159			338								5,307			2,345	6,900
Portugal	26								8,600	1,000			680		23		16,859
Roumania		624															11,284
Russia in Europe	1,019	20,335			18		15	128	12,100	908	3,300	438	28,924			2,768	64,197
Servia, Montenegro	450																
Spain	4,052	181,913	108	2,219		111,809	5	123					146,185	422,169		2,010	277,125
Sweden	569				1,253								1,405	30,113			10,709
Switzerland	709												115			66	6,743
Turkey in Europe	168	224	45	500	303				200	35			181	9,452			11,598
England	64,696	323,987	3,332	39,956	125,044	67,130	217	4,016	561	68	1,012	278	428,587	35,136	14,548	54,643	544,616
Scotland	4,711	8,595	185	1,871	8,341								32,572		3,385	184	26,460
Ireland	77				108												2,836
Bermuda	419		8	106	2,453	2,797	1	12	292	43	7,534	1,846	834	690		1,131	5,034
British Honduras	1,535	645	8	79	1,371	74			66	9	2,450	577	736	188		12	4,782
Canada	304,656	397,193	6,334	69,727	266,794	416,305	1670	34,913	54,583	6,696	75,568	25,585	832,895	105,810	15,524	431,526	3,759,653
Costa Rica	1,067	6,587	29	329	4,322	11			13,976	1,657	7,017	1,767	7,075	13,396		3,526	84,231
Guatemala	372	2,538	1	14	3,101				2,020	464	760	186	1,606	1,074	268	3,778	12,782
Honduras	1,782	2,030	16	208	4,948	151			500	60	1,390	358	2,198		100	4,130	24,381
Nicaragua	2,278	466			898	28					4,360	882	6,464	350	2,729	2,405	28,258
Panama	10,381	43,455	260	3,573	273,241	10,931	27	512	31,230	4,813	66,020	8,153	221,178	136,649	11,059	10,448	566,481
Salvador	2,749	5,319	11	98	3,807	798	2	66	7,050	1,182	9,664	2,327	2,458	1,963	340	14,275	19,977
Mexico	33,296	25,532	557	6,090	100,228	17,426	132	2,194	746,214	97,810	144,891	30,718	263,847	99,501	9,216	23,140	326,391
Miquelon, Lang'y, &c	355															208	127
Newfoundland	6,306	115			14,009	337	48	509	12,308	2,670	26,542	7,896	7,666	8,537	2,454	2,351	26,912
Barbadoes	394	95			654	65					50	15	333			842	790
Jamaica	2,316	569	23	347	2,812	2,249	1	27	762	180	5,392	1,808	4,016	1,628	85	1,927	14,198
Trinidad, Tobago Is.	932	308	41	504	2,226	790					3,482	845	196	465		1,294	9,393
Other Br. W. Indies	1,267	388	22	167	824	633			137	36	875	379	233		347	933	3,700
Cuba	25,621	234,976	626	7,504	215,427	66,654	309	6,128	50,839	5,876	73,904	18,181	131,079	55,095	1,088	81,664	374,071
Danish W. Indies	63												5				487
Dutch W. Indies	116		3	41	363	228			72	13			102	70		45	949
French W. Indies	124	4			17		1	20					97			4	154
Haiti	256		1	12	1,193	966			600	96	2,532	873	305	1,073	110	1,722	4,360
Santo Domingo	761	6,039	32	348	29,629	10,394	27	574	5,944	786	10,172	2,898	3,205	1,351	2,110	4,714	32,498
Argentina	13,465	15,263	6,715	87,246	12,490	422	1	20	41,812	4,288	71,825	12,765	109,057	4,628	930	100,516	358,223
Bolivia	74	9,714			333						445	95	16,322	2,734		559	1,880
Brazil	28,926	136,369	2,277	25,742	322,856	3,424	1146	13,832	54,478	10,364	56,555	24,669	179,315	147,712	28,703	336,027	946,814
Chile	2,054	19,687	168	1,630	45,952	26,175	90	1,880	53,275	6,780	31,996	8,344	92,747	37,839	637	3,374	161,810
Colombia	3,962	16,903	148	1,601	25,152	3,950	126	2,911	10,676	2,099	32,762	8,449	24,754	5,431	6,413	7,132	45,125
Ecuador	2,313	3,895	30	290	5,231		7	113	1,700	280	6,551	1,488	6,323	655	3,730	721	44,966
British Guiana	247	892	12	175	177	452	5	95	3,400	382	6,898	1,350	973	268	11	1,193	7,709
Dutch Guiana	6				6						72	27					431
Paraguay	145												809				649
Peru	4,709	12,081	42	380	25,496	840	30	641	26,675	3,647	20,524	4,186	68,350	8,532		5,079	112,404
Uruguay	2,309	12,127	972	16,552	1,850				746	170	2,839	676	15,993	1,800		473	21,666
Venezuela	7,789	5,921	8	167	24,147	17,034	59	1,168	12,591	2,209	13,471	3,862	10,564	18,079	790	20,689	53,262
China	5,029	13,089	959	26,581	16,485				1,850	480	2,261	662	23,577	16,882	156	11,795	71,332
German China													50				
Japanese China		16,253	130	3,694	1,357								13,898	88			17,349
Chosen (Korea)	76	20,143	4	72		1,625							11,561	16,030		139	44,924
British India	5,176	7,979	3,641	47,455	51,116		4	30	2,548	383	6,850	4,030	98,761	19,055		919	126,626
Straits Settlements	886	8,229	18	372	177								3,178				5,703
Other Br. E. Indies	55	7,033	181	2,694									6,051				1,849
Dutch East Indies	193						5	95					158				1,035
Hongkong	429	9,949	1,784	30,376	1,784	340					12	3	8,095	1,890			6,289
Japan	5,906	869,405	1,863	25,025	27,962	13,383	40	950	1,000	270	4,875	1,341	828,664	23,291	8,106	13,671	483,468
Russia in Asia	12	245											761				
Siam			34	912	1,298								11,182	27,144			3,347
Turkey in Asia	250	224	42	574							200	56	105			43	761
Australia, Tasmania	35,113	91,880	1,025	10,494	121,181	17,726	74	1,101	29,828	5,027	67,499	12,802	268,359	46,641	1,345	277,477	515,647
New Zealand	10,662	2,414	83	1,420	1,096	2,018	50	730	1,325	154	5,337	1,555	14,263	11,088		50,667	70,574
Other Br. Oceania	218	75											801				556
French Oceania	1,742	158			40						200	64	85			175	4,055
German Oceania	288																589
Philippine Islands	24,866	27,915	784	11,914	103,397	30,178	12	137	6,760	931	23,515	6,446	96,745	6,194	14,003	20,935	243,636
British West Africa													6,085				355
British South Africa	10,569	12,290	87	1,634	15,868	108	105	1,253	95	15	31,735	6,359	190,656	25,591		1,634	106,200
British East Africa					204								677				135
Egypt	51												1,388				419
Liberia			4	51													57
Portuguese Africa			3	81	538						2,110	448	17,177	39,289		74	30,023
Total	$685,640	$2,634,365	32,816	$432,656	$1,992,304	$721,039	4386	$76,766	1,285,858	$172,064	849,261	$219,439	$4,541,541	$1,455,343	$136,592	$1,552,951	$10,440,114

Corporate and Financial

Niagara, Lockport & Ontario Notes.—The Bankers' Trust Company of Buffalo offers a limited number of Niagara, Lockport & Ontario Power Company 6 per cent collateral notes, due Oct. 1, 1916, to net approximately 8 per cent.

Federal Utilities Elect President.—Directors of the Federal Utilities Company, Inc., have elected Mr. George T. Ordway president to succeed Mr. De Forest Candee, resigned. Mr. Ordway is connected with the banking firm of Bertron, Griscom & Company. Mr. Candee will continue as a director.

Alabama Power Sued.—Suits have been filed for damages aggregating over $500,000 against the Alabama Power Company, which is controlled by the Alabama Traction, Light & Power Company, Ltd. It is charged that the water stored up by the Coosa River dam has caused mosquitoes and other insects to thrive, thereby causing illness. The government will make an investigation to find out whether there has been an accumulation of water by reason of the dam.

Virginia Railway & Power Company.—The Virginia Railway & Power Company has applied to the City Council of Richmond, Va., for a new thirty-year franchise to cover franchises already held. The ordinance, as submitted by the company, is simply a preliminary draft, containing the principal features of the present ordinances. The company hopes that when the ordinance is taken up by the City Council some modifications will be made in the conditions therein contained.

Better Conditions Prevailing.—That better conditions prevail in the unlisted securities market is asserted by Messrs. Williams, Dunbar & Coleman, of New York, in their review, in which they say: "Trading in unlisted securities has been more active during the last week and inquiries for public utilities broadened materially. We still believe that the present time is propitious for purchasing high-class unlisted securities. The record established by public utilities for earnings during the past months, when so many railroads and industrials have been adversely affected, is sufficiently convincing to warrant their selection by investors."

Detroit Edison Offers Bonds to Stockholders.—The Detroit (Mich.) Edison Company will offer to its stockholders on Dec. 10 at par the unissued balance, $2,645,500, of its ten-year 6 per cent convertible debenture bonds. These bonds will be convertible Jan. 15, 1917, and Jan. 15, 1923, at the option of the holders, into paid-up shares of the stock of the company of the same par value. The bonds are dated Jan. 15, 1915, and mature Jan. 15, 1925. Payment may be made in three instalments at the Bankers' Trust Company, New York; 50 per cent Jan. 15, 1915, 25 per cent April 15, 1915, and 25 per cent July 15, 1915. All applications must be made on or before Jan. 15, at which time the unsubscribed portion will be sold to bankers who have underwritten them. The bankers who underwrote these bonds are Spencer, Trask & Company, and F. S. Smithers & Company.

Consumers' Power Bond Offering.—Perry, Coffin & Burr, of Boston and New York, and Harris, Forbes & Company, of New York, are jointly offering $1,146,000 of first lien and refunding 5 per cent gold bonds of the Consumers' Power Company of Michigan, dated Jan. 2, 1911, and due Jan. 1, 1936. These bonds are part of an authorized issue of $35,000,000, of which $12,936,000 is outstanding. These bonds are secured, through the deposit of securities, by a first lien on all the properties of the following constitue companies: Flint Electric Company, Pontiac Power Company, Saginaw Power Company, Bay City Power Company, Consumers' Power Company of Michigan, Economy Power Company, Au Sable Electric Company and Central Power Company. They are further secured by a lien on the following properties, subject to their outstanding bonds: Commonwealth Power Company, Grand Rapids-Muskegon Power Company and Grand Rapids Edison Company. The Consumers' Power Company, through its constituent companies, controls the light and power business in a large section of Michigan, of which the population is more than 450,000. At present this block of escrow bonds is selling at 90 to net 5.82 per cent.

NEW ENGLAND LOCALLY AFFECTED

Central Stations in New England Generally Did Well in September—Operations Reflect Industrial Conditions During Month

The September operations of the electric utilities of New England, while not showing so large a growth as was shown in previous months, were well ahead of the September figures of last year. The companies generally did well, in fact as well as in former months. Many of New England's large industries are largely localized, and when one of these industries suffers a depression the entire locality feels the effects. Such was the case with some of the central stations, and as a result they experienced a decrease in comparison with 1913. Had these companies been left out of the compilations, the resulting figures would compare favorably with the ante-war figures.

The comparative figures in Table I include returns from companies of all sizes and from every state. It will be noticed that the income growth rate has decreased but slightly from the average rate of somewhat over 8 per cent. The output growth rate has fallen considerably. The demand for higher-priced energy has been maintained during the period of industrial curtailment. The figures in Table II, while not strictly comparable, show the same results to a somewhat lessened degree.

TABLE I—COMPARATIVE RETURNS OVER A FIVE-MONTH PERIOD COVERING 60 PER CENT OF THE ELECTRIC-UTILITY INDUSTRY OF THE NEW ENGLAND STATES

	Income Derived from Sale of Energy			Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
May	$1,704,102	$1,573,119	8.4	51,519,410	49,752,133	3.6
June	1,467,791	1,356,552	8.3	50,456,031	45,268,312	11.6
July	1,551,797	1,419,597	9.3	50,644,731	45,861,737	10.4
August	1,608,730	1,489,213	7.5	52,398,832	49,576,095	5.5
September	1,658,740	1,556,250	6.7	55,056,974	53,017,201	3.9

The returns for August and September have been broken up first into states and then into communities of various sizes, to see whether or not the war has caused any lasting effects and if so in what direction. In both compilations the data from the holding companies have been left out, inasmuch as these data are in a lump form and therefore cannot be localized. Also the same companies have been taken for both months, so that our figures are strictly comparable. Our returns from Vermont, outside of holding companies, included but one company, so that Vermont has not been included in the figures for our state group.

Ten companies in Massachusetts reported a 9 per cent growth in income in August and a 6.3 per cent growth in September. The output from the same companies showed a growth of 3.8 per cent in August and 2.6 per cent in September, the growth being over the corresponding month in the previous year. Two companies in Rhode Island gave a 15.4 per cent growth in income in August and a 8.5 per cent growth in September, the output growths being respectively 18.5 per cent and 17 per cent. Three Connecticut companies for August showed a 5 per cent growth in income and a 3.7 per cent growth in output. In September these companies registered a 3 per cent income growth and a 0.2 per cent decrease in output. Three companies from Maine for August and September respectively showed income growths of 2.5 per cent and 6.5 per cent and output growths of 3.4 per cent and 3 per cent. Three companies from New Hampshire for the two months showed growths of 3.5 per cent and 1.7 per cent in income and 6.6 per cent and 3.1 per cent in output. With the exception of Maine each of the states fell behind in growth rate. Maine seems to have reached a turning point and should show better results for October. The other states showed

such a small difference in growth rate that it is highly probable that they reached their low point some time after the middle of September. With the exception of the cotton industry and some of the minor industries, the tone of New England's manufacturing was much better toward the end of September than at the beginning.

The second treatment of these figures by cities contains four groups. In the group of cities whose population is over 100,000 are the returns from five cities. The August figures show a 10.5 per cent growth in income and a 5.1 per cent growth in output. The September figures show a 6.1 per cent growth in income but a 1.2 per cent decrease in output. The next group contains seven cities whose population is between 50,000 and 100,000 inhabitants. The growths for August and September were 4.8 per cent and 6.4 per cent in income and 15 per cent and 13.2 per cent in output. The third group contains four cities whose inhabitants number between 25,000 and 50,000. The cities recorded a decrease for both months, the decrease in income being 0.6 per cent and 0.4 per cent and the decreases in output being 7.1 per cent and 6.4 per cent. In the last group there are six towns whose population is less than 25,000. For the two months the growth percentages were 10 per cent and 8.3 per cent in income and 2 per cent and 4.2 per cent in output. The medium and small-sized cities did well in September in comparison with the month of August, and the figures indicate that a turning point has probably been reached, as was borne out in our other groupings.

Industrial Review

A review of the industrial conditions in New England and September will act as a key to a more nearly complete understanding of the operating figures from the central stations. In the first week the shoe factories were doing fairly well but were curtailing. The mills engaged in the production of dress goods and woolen goods reported better conditions. All factories were working on old contracts and spot orders. The uncertainty of the future and the stringency of money forbade the booking of orders far in advance. The second week saw somewhat better conditions. Money was easier. The factories engaged in making shoes, silk goods, lace, woolen goods and paper reported as doing fairly well. In all cases the trend of the market was irregular. Buyers were buying for immediate use and salesmen were cautioned to go slow in booking orders. Cotton manufacturers reported a curtailment. In the third week the volume of business was not large but there was a firm undertone. The outlook became very favorable. Firearms, of course, were in great demand. The smaller isolated industries "fell down," but the larger ones reported conditions as better. The last week of the month saw quiet conditions with a certain betterment. Woolen, lace and silk mills and jewelry factories reported business as active. The shoe trade was quiet but the outlook was good. The textile industry was unsatisfactory. This trade has felt the loss of the German dye trade. The demand for granite was poor. With the Christmas orders many of the mills, especially the jewelry mills, are enabled to prevent curtailment.

Considering the month as a whole, it will be seen that conditions grew better all through the month. The large war orders of October ought to make for better conditions throughout the New England States. The patriotic demand for cotton goods will make itself felt in this region.

TABLE II—RETURNS FOR HALF-YEAR PERIOD FROM NEW ENGLAND ELECTRIC UTILITIES

	Income Derived from Sale of Energy			Energy Output in Kw-hr.		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
April (52 per cent of industry)	$1,501,773	$1,384,225	8.5	43,386,624	39,181,988	10.8
May (65 per cent of industry)	1,745,160	1,609,234	8.4	52,752,247	50,779,103	3.9
June (67 per cent of industry)	1,560,872	1,442,178	8.3	53,463,013	48,049,756	11.1
July (70 per cent of industry)	1,670,819	1,530,410	9.2	54,074,533	49,255,893	9.8
August (71 per cent of industry)	1,734,583	1,607,649	7.5	55,801,224	52,913,483	5.4
September (71 per cent of industry)	1,811,762	1,696,997	6.8	59,763,538	57,081,873	4.7

Business Notes

The Power Specialty Company, 111 Broadway, N. Y., has removed its office at Chicago from the People's Gas Building to the Harris Trust Building.

Ralph B. Clapp, Los Angeles, Cal., is now representing the Electrical Engineers' Equipment Company, the Electro-Magnetic Tool Company and the Pittsburgh Transformer Company.

The Western Electric Company, New York, has leased the ground floor of a large building in course of construction on Park Place, Newark, N. J., where it will open an electrical supply house.

New Industrial Companies

The Imperial Electrical Company, of Union City, Ind., has been incorporated with a capital stock of $1,000 by B. H. Garver, W. S. Buchanan and A. N. Hercules. The company purposes to manufacture and sell electrical devices.

The Universal Chain & Metal Stamping Company, of New York, N. Y., has been incorporated by Brinton Carrigan, John L. Cohen and Charles Robertson, 806 Greenwich Street, New York. The company is capitalized at $10,000 and purposes to manufacture metal goods and electrical appliances.

Trade Publications

Insulating Tapes.—"Westinghouse Insulating Tapes" is the subject of Folder No. 4286 issued by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

Synchronous Converters.—Bulletin No. 42,500 of the General Electric Company contains a discussion of the characteristics and adaptability of synchronous converters made by that organization.

Water Heater.—An electric water heater which can be attached to any faucet is referred to in a booklet distributed by the Geyser Electric Water Heater Company, 42 Hudson Street, New York City.

Lineman's Shield.—The Withers lineman's protector for inclosing conductors carrying high potentials is described in a folder prepared by the Associated Engineers Company, 180 North Dearborn Street, Chicago.

Air Compressors for Foundries.—Bulletin No. 42,800 recently issued by the General Electric Company contains an article comparing motor-driven centrifugal compressors with other blowers for foundry service.

Substation Equipment.—Circular No. 1550, which is being distributed by the Westinghouse Electric & Manufacturing Company, contains descriptions of some 1500-volt direct-current railway substations in this country.

High-Efficiency Incandescent Lamps.—The Edison Lamp Works of the General Electric Company, Harrison, N. J., have issued Bulletin No. 43,603, which contains information on various types of high-candle-power incandescent lamps.

Alternating-Current Machinery.—Vertical-type and horizontal-type alternating-current generators which can be belt-driven or directly connected to the prime mover are described in Leaflets Nos. 303, 356, 376, 383, 410, 424 and 476 issued by the Electric Machinery Company, Minne-

apolis, Minn. Leaflet No. 480 of that company refers to induction motors.

Wiring Devices.—In Catalog No. 16 issued by the Arrow Electric Company, Hartford, Conn., various wiring devices are described and illustrated.

Garage Lamps.—Frank W. Morse, Boston, Mass., has issued a leaflet containing information on a portable lamp and a floor lamp for use in garages.

Ball Bearings.—The Abbott Ball Company, Hartford, Conn., has issued a small folder announcing that special machinery has been installed in its plant.

Water Weighers.—The Kennicott Company, Chicago Heights, Ill., has issued Bulletin No. 41, which describes water weighers and condensation meters.

Push-Button Devices.—A catalog entitled "Push-Button Specialties" has recently been published by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

Steam-Engine Plants.—The Murray Iron Works Company, Burlington, Ia., has issued Pamphlet No. 12, which includes a number of diagrams of Corliss engine installations.

Polyphase Induction Motors.—Bulletin No. 123 issued by the Robbins & Myers Company, Springfield, Ohio, describes and illustrates the type "K" polyphase induction motors.

Electrical Equipment for Theaters.—A booklet entitled "Electrical Equipment for the Theater" has been issued by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

Portable Voltmeter.—Bulletin No. 46,018, recently issued by the General Electric Company, Schenectady, N. Y., describes and illustrates a portable voltmeter, designated as type P-8.

Telegraph Instrument.—An instrument for improving telegraphic communication is described in a booklet prepared by J. H. Bunnell & Company, 32 Park Place, New York City.

Fiber Conduit.—An attractively illustrated eighty-four-page catalog describing various kinds of light-weight conduit has been issued by the Fibre Conduit Company, Orangeburg, New York.

Motor Equipment.—The Wagner Electric Manufacturing Company, St. Louis, Mo., has issued Bulletin No. 98, which is printed in Spanish and which describes various types of motors and other electrical apparatus.

Radio Telephone Outfit.—Apparatus for carrying on radio-telephonic communication is described in a pamphlet being distributed by the De Forest Radio Telephone & Telegraph Company, 101 Park Avenue, New York City.

Lighting Fixtures.—Plates Nos. 25, 26, 36 and 38 give illustrations of lighting equipment put out by the National X-Ray Reflector Company, Chicago, Ill., suitable for stores, gymnasiums, show and wall cases and central stations.

Domestic Refrigerating Outfit.—Information regarding a 300-lb.-a-day domestic refrigerating set driven by electricity is given in Bulletin No. 20 sent out by the firm of Westerberg & Williams, Woolworth Building, New York City.

Switchboards.—The Western Electric Company, New York, has issued Catalog No. S-1, which is printed in Spanish for South American and Central American trade and which describes and illustrates various types of switchboards.

Station Devices.—A folder recently published by the General Devices & Fittings Company, 817 West Washington Boulevard, Chicago, Ill., contains descriptions and illustrations of various types of low-tension and high-tension station devices.

Jointless Grid Resistors.—Various types of grid resistors, the sections of which are made in continuous pieces, are described in bulletins issued by the Electro-Mechanical Brake Company, West Bromwick, England, the American agent for which is the Ellcon Company, 50 Church Street, New York.

Electrical Devices for Christmas Presents.—Landers, Frary & Clark, New Britain, Conn., have issued Bulletins No. 497 and No. 505, which list various devices suitable for Christmas gifts. Bulletin No. 508 contains illustrations of electrotypes which the above company is prepared to send to dealers for newspaper advertising.

Personal Mention

Mr. Morgan Ellis, Chicago, has been appointed second tribune of the Chicago Jovian League to fill the vacancy created by the resignation of Mr. Victor R. Desjard.

Mr. Alexander Shane, safety inspector for the Middle West Utilities Company, Chicago, has been elected vice-president of the local Chicago section of the National Safety Council.

Mr. Delos F. Wilcox, for many years head of the bureau of franchises of the Public Service Commission, First District, New York, was recently appointed deputy commissioner of the Department of Water Supply, Gas and Electricity of New York City.

Mr. C. G. MacAvoy, who was manager of the Bellefonte (Pa.) Electric Company for over six years, has been retained as superintendent of the Dansville (N. Y.) Gas & Electric Company by the new owners of the property. Mr. MacAvoy has been superintendent of the company for the past six months, under the old management.

Mr. L. T. Mason has been elected president of the Dansville (N. Y.) Gas & Electric Company, which recently changed ownership. Mr. Mason was one of the incorporators of the Hornell (N. Y.) Electric Company twenty-eight years ago, and he has been its manager ever since. He was also manager for a time of the Atlantic City (N. J.) Electric Company, dividing his time between Hornell and Atlantic City, until the work in the former city became so heavy as to take up all of his time. Mr. Mason will still retain his position as manager of the Hornell Electric Company.

Mr. J. Harry Pieper, assistant to the general agent of the Southern California Edison Company, has been elected president of the Los Angeles Ad Club. This is the organization that captured the *Printers' Ink* Cup at the last convention of the Associated Ad Clubs for its record of efficiency in promoting the advancement of the locality it serves and the interests of better advertising during the preceding year. Mr. Pieper's connection with Ad Club work comes through his development of advertising by electrical methods. His recent election to the office of statesman of the Southern California Jovian Electrical League was noted in the *Electrical World* for Oct. 31.

Mr. A. A. Pope, who was recently elected chairman of the Sales Managers' Association of Edison Companies, is assistant general inspector of the New York Edison Company and well known in lighting circles. Mr. Pope was born in Brooklyn and acquired his first electrical experience in Roselle, N. J. This place was the home town of Mr. M. F. Moore, one of the early officials of the parent concern of what is now the New York Edison Company. Some time before the opening of the old Pearl Street station in New York, an exhibition of an electric-light plant was given in the Old Mansion House in Roselle, and this simple plan so interested Mr. Pope that he was a frequent visitor to the old Pearl Street station. In 1889 this interest found Mr. Pope connected with the electrical industry as a wireman's helper for the Brooklyn Edison company. The following year he left the Brooklyn company and went to New York, joining the underground construction force. In 1891 he became an inspector in the contract and inspection department, with which he has been identified ever since. Mr. Pope has been active in committee work in the National Electric Light Association, in the Association of Edison Illuminating Companies and in the Sales Managers' Association. He is also one of the charter members of the Illuminating Engineering Society.

A. A. POPE

Construction

New England

GREENVILLE, N. H.—Within the next few months the Greenville El. Ltg. Co. expects to purchase a boiler-feed pump. H. J. Taft is treasurer.

LANCASTER, N. H.—The Lancaster & Jefferson El. Co., of Lancaster, expects to purchase within the next eight months one 140-hp horizontal tubular boiler (125 lb. pressure). Walter U. Colby is superintendent.

LYNN, MASS.—Bids will be received by George A. Cornet, commissioner of public property, City Hall, Lynn, until Nov. 24, for furnishing material and installing the electric wiring and lighting system in the new Blossom Street school building. Specifications and form of tender may be obtained at the office of the commissioner. Plans may be obtained at the office of M. F. Burk, 333 Union Street, Lynn.

SALEM, MASS.—The Salem Chamber of Commerce is considering the question of improving the street-lighting system in the business section of the city.

Middle Atlantic

HANNAWA FALLS, N. Y.—The Aluminum Co. of America, which recently acquired control of the Hannawa Falls Wtr. Pwr. Co., with water rights on the Raquette River, near Potsdam and Colton, is securing right-of-way for a high-tension transmission line from Hannawa Falls and Massena, a distance of 30 miles, which will connect its plants at Cedar Rapids, Massena, Hannawa Falls and Higley Falls. The line will be carried on steel towers and aluminum cable will be used.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, until Nov. 30, for installing an electric elevator in Public School 62, Hester, Essex and Norfolk Streets, borough of Manhattan. Blank forms, plans and specifications may be seen or obtained at the office of the superintendent, and also at the branch office, 69 Broadway, Flushing, borough of Queens.

NEW YORK, N. Y.—Bids will be received by the Board of Trustees, Bellevue and Allied Hospitals Department of New York City, Bellevue Hospital, 415 East Twenty-sixth Street, New York, until Nov. 23, for furnishing and installing all electric and gas fixtures in pavilions "L" and "M" of the new Bellevue Hospital at Twenty-sixth to Twenty-ninth Street, First Avenue to East River, borough of Manhattan. Blank forms and further information may be obtained at the office of the contract clerk and auditor, at 400 East Twenty-ninth Street, New York. John W. Brannan, M.D., is president of board.

SCHROON LAKE, N. Y.—The Leland House (owned by James A. Emerson, of Warrensburg, and L. W. Emerson) and the electric-light plant connected with the hotel were destroyed by fire on Nov. 1.

SYRACUSE, N. Y.—Commissioner Hitchcock of the Department of Public Safety is considering the establishment of additional ornamental lighting districts. It is proposed to erect ornamental standards carrying single lamps of 100 cp in the residential districts. If the project is carried through, the property owners will bear half the expense of maintaining the lamps.

WATERTOWN, N. Y.—The City Council has adopted a resolution authorizing the city attorney and the city engineer to engage an electrical engineer to prepare estimates of the cost of building and maintaining a municipal electric-light plant; also to give an estimate of the present value of the distribution system of the Watertown Lt. & Pwr. Co. for street-lighting and commercial service.

BAKERTON, PA.—Arrangements have been made whereby the Sterling Coal Co. will supply electricity to operate the machinery in the mine of the Barnes-Tucker Coal Co., both of Bakerton.

CENTER VALLEY, PA.—Work will soon begin by the Coopersburg El. Lt. & Pwr. Co., of Coopersburg, on the erection of a transmission line from the Coopersburg substation of the Lehigh Valley Lt. & Pwr. Co. to Center Valley, a distance of 2 miles, to supply electricity for lamps and motors here.

HASTINGS, PA.—At an election held recently the proposal to issue $32,000 in bonds for a municipal electric-light plant was carried.

HOMER CITY, PA.—Application for a charter has been filed for the Homer Lt., Ht. & Pwr. Co., of Homer City, at the office of the Public Service Commission. The company proposes to supply electricity in the borough of Homer City.

LANSFORD, PA.—The capital stock of the Panther Valley El. Lt., Ht. & Pwr. Co., of Lansford, has been increased from $10,000 to $80,000.

LILY, PA.—Arrangements have been made by the Town Council with Julius F. Klemstine, owner of the local electric-light plant, for improvements to the street-lighting system.

PITTSBURGH, PA.—The Bureau of Electricity has filed a requisition with the City Council asking for $26,082 to be used for underground cable extension in Second Avenue between Second Avenue and Glenwood Bridge.

PITTSBURGH, PA.—The Smithfield Street Business Men's Association has petitioned the City Council for the installation of ornamental lamps on Smithfield Street similar to those erected on Federal Street, Penn Avenue and other thoroughfares of the city.

PITTSBURGH, PA.—The contract for electrical work in connection with Schenley High School has been awarded to the Craig El. Co., of Pittsburgh, at $35,900, by the Board of Education. Reported in the issue of Nov. 14 that the bid of Loughridge Engineering Co., of Pittsburgh, at $36,172, was recommended by the finance committee.

NEWARK, N. J.—The Board of Public Works has approved seven ordinances granting the Public Service El. Co. permission to extend its lighting system in different sections of the downtown district.

NEWARK, N. J.—The Borough Council of East Newark is contemplating the installation of an ornamental street-lighting system. This improvement will be made in connection with a new lighting contract with the Public Ser. El. Co.

PENNINGTON, N. J.—The Hopewell Township committee is considering the installation of a street-lighting system along the road from the Ewing Township line to Pennington.

PERTH AMBOY, N. J.—At the election held Nov. 3 the citizens voted in favor of municipal ownership of the electric-lighting system.

ABINGDON, VA.—The Bristol Gas & El. Co., of Bristol (it is reported) has been granted a franchise to supply electricity for lamps and motors in Abingdon for a period of 30 years. Under the terms of the franchise the system is to be completed within 18 months.

CLARKSVILLE, VA.—At an election held recently the proposal to issue $6,000 in bonds for the installation of a municipal electric-light plant was carried.

STAUNTON, VA.—The City Council has passed an ordinance providing for an issue of $30,000 in bonds for the installation of a new municipal electric-lighting plant in Staunton.

WASHINGTON, D. C.—Arrangements have been completed, it is reported, by Walter C. Allen, district electrical engineer, for the installation of about 900 incandescent lamps, to replace arc lamps on various streets during the winter and spring. Among the improvements contemplated for the spring is the installation of four rows of lamps on Pennsylvania Avenue between Second and Seventeenth Streets, Southeast.

WASHINGTON, D. C.—Foreign trade opportunities as announced by the Bureau of Foreign and Domestic Commerce in the Daily Consular and Trade Reports: No. 14,392—A contractor and dealer in railway materials in a Mediterranean Sea country is desirous of entering into correspondence with American manufacturers and exporters of railway material in general, especially roadbed material, such as rails, steel cross-ties, bolts, nuts, washers, crossarms, poles, etc. No. 14,399—An established firm of importers and agents in northern Europe wishes to represent American exporters of motor accessories and lubricating oils. No. 14,341—A manufacturer's agent in Canada desires to be put in touch with dealers in and manufacturers of electric auto-trucks with a view to representing a leading truck in his district. No. 14,342—Supplements a report which appeared in Daily Consular and Trade Reports of Sept. 5 and Foreign Trade Opportunity, No. 13,964—The American consul at Port Elizabeth, South Africa, has transmitted the third instalment of specifications for the Port Elizabeth municipal electric-light plant No. 14,345—An American consular officer in East Africa reports that he has an inquiry for two or three railway motor carriages, which the government proposes to purchase through an agent in his district. No. 14,353—An American consular officer reports that municipal authorities of a city have advertised a concession for an electric-lighting plant to be installed in the near future. No. 14,422—A firm in the United Kingdom is in the market for all classes of opal glass and enameled-iron shades, insulating materials, such as black adhesive tape, half-proofed tape, Chatterton's compound, shellac, manila paper tape, suitable for use in the manufacture of electrical cables. No. 14,447—An electric-light company in South America would like to receive catalogs from American manufacturers of electrical appliances of all kinds, except power-plant equipment. No. 14,301—An American consul in northern Europe reports the name of a firm which desires to purchase electrolytical copper in large quantities. No. 14,315—A firm of electrical engineers in Australia informs an American consul that it desires to be placed in communication with actual manufacturers of insulators. No. 14,316—An American consul in Great Britain writes that a firm advises that increased prices will have to be paid in the future for porcelain roses, porcelain and brass lamp holders, porcelain and brass sub-switches, electric cables of all classes, glassware in the form of shades, bowls and reflectors, and bells and telephones; in view of this fact American manufacturers may compete successfully. No. 14,323—An American consul in France has been advised by a firm that it desires to obtain the agency for France of one or more American firms manufacturing steam-driven and electrically driven shovels, excavating machinery and dredges. No. 14,117—A firm of electrical engineers dealing in electrical supplies and electrical machinery of various kinds in a city in southern Europe has requested an American consular officer to supply addresses of American manufacturers in these lines; illustrated catalogs, price lists, and conditions of sale are desired; the firm is particularly interested in electrical machinery, turbines, electrolytic copper, telephones and electric supplies generally; correspondence should be in Spanish. Prices should be c.i.f. destination. No. 14,196—An American consular officer in England reports the name and address of a firm in his district which is desirous of corresponding with manufacturers of arc-lamp carbons with a view to purchasing in considerable quantities. No. 14,351—An American consular officer reports that municipal authorities of a city in his district have advertised a concession for an electric-lighting plant to be installed in the near future and that there will probably be a demand for electrical supplies; the consular officer has submitted a list of dealers in his district who might be in a position to represent American firms; a copy of the list may be had on application to the Bureau of Foreign and Domestic Commerce. Further information may be obtained on application to the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C.; or the following branch offices: Room 409, United States Custom House, New York, N. Y.; 629 Federal Building, Chicago, Ill.; Association of Commerce Building, New Orleans, La.; 310 United States Custom House, San Francisco, Cal.; Post Office Building, Atlanta, Ga.; 1207 Alaska Building, Seattle, Wash., and 752 Oliver Building, Boston, Mass.

North Central

BENTON HARBOR, MICH.—Ornamental lamp standards will be erected on West Main Street and East Main Street at a cost of about $8,000.

CHASSELL, MICH. — The Worcester Lumber Co., owner of the local electric-light plant, expects to purchase wiring supplies to the amount of from $300 to $400 between now and May 1, 1915, as needed. W. H. Madden is electrician.

DETROIT, MICH.—The Edison Illg. Co. of Detroit has applied to the State Railroad Commission for authority to issue $2,645,500 in bonds, the proceeds to be used for improvements and extensions, principally at the new Conner's Creek plant at the foot of Lycast Avenue.

DETROIT, MICH.—Smith, Hinchman & Grylls, architects, have obtained a permit for the construction of an addition to the municipal electric-light plant at 50 Water Street, to cost about $14,000. The new building will be used as switchboard and transformer room.

DETROIT, MICH.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 25, for the extension and remodeling, etc., of the United States post office and court house at Detroit. Drawings and specifications may be obtained at the above office or from the custodian at Detroit. O. Wenderoth is supervising architect.

DETROIT, MICH.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 12 for mechanical equipment (ex-

cept elevators) for the extension to the United States post office and court house, Detroit, Mich., in accordance with plans and specifications, copies of which may be obtained from the above office or the custodian of site at Detroit. O. Wenderoth is supervising architect.

FENTON, MICH.—All bids submitted for the installation of an ornamental street-lighting system have been rejected. The Council has decided to purchase the material and install the system under the direction of E. A. Lockwood, village engineer.

HARTFORD, MICH.—Within the next six months Anderson Brothers, owners of the local electric-light plant, expect to purchase one 75-kw, 2200-volt alternator and exciter. M. J. Anderson is manager.

ROGERS, MICH.—The contract for the construction of power house for the municipal electric-light plant has been awarded to I. N. Hagle, at $1,050. The building will be 40 ft. by 60 ft., of brick construction.

CLEVELAND, OHIO.—The Cleveland Lt. & Pwr. Co. has been granted permission by the City Council to lay and maintain pipes and conduits on certain streets to transmit and supply steam and hot water in the city of Cleveland.

CLEVELAND, OHIO.—The City Council has passed an ordinance granting the Cleveland El. Illg. Co. permission to lay and maintain pipes and conduits in certain streets for the transmission and supplying of steam and hot water in the city of Cleveland.

FREMONT, OHIO.—A movement has been started by the Chamber of Commerce for the installation of ornamental lamps in the business district.

LORAIN, OHIO.—A special committee has been appointed by the City Council to make investigations and secure data relative to the installation of a municipal electric-light plant in Lorain. It is proposed to submit the proposal to issue bonds for the installation of the plant to the voters at the next municipal election. The cost of the plant is estimated at about $400,000.

MASON, OHIO.—Bids will be received by R. W. Gutermuth, village clerk, Mason, until Nov. 30 for construction of power plant and equipment as follows: (1) For boiler, engine, heater, pump, feed pump, injector, steam piping, belts, etc.; (2) one generator, exciter, switchboard, lamps, transformers, etc.; (3) poles, distribution circuits, lamp hangers, transformer mountings, etc.; (4) construction of brick or concrete power-house building; (5) alternative to No. 1—oil engine, dynamo and exciter, belts, etc. Plans and specifications may be seen at the office of the village clerk, Mason; copies may be obtained of H. C. Babbitt, of Lockland, Ohio, upon payment of $2, which will be refunded upon return of same.

TEDROW, OHIO.—The Toledo & Indiana R. R. Co., of Wauseon, is reported to be contemplating extending its transmission line from Ottokee to Tedrow to furnish electricity here.

TIFFIN, OHIO.—Preliminary steps, it is reported, have been taken by the Ohio Lt. & Pwr. Co., of Tiffin, to move its plant from its present location in the center of the city to a point in the suburbs of the city on the Big Four railroad.

LOUISVILLE, KY.—Plans are being considered by the Schoppenhurst Dry Cleaning & Dyeing Co., of Louisville, it is reported, for the construction of a power plant. The equipment will include boilers, engine and generator.

MIDDLESBORO, KY.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 23, for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Middlesboro, Ky. Drawings and specifications may be obtained at the above office or from the custodian of site at Middlesboro. O. Wenderoth is supervising architect.

NEW HAVEN, KY.—At an election held recently bonds to the amount of $4,500 were voted for the installation of a municipal electric-light plant.

PRINCETON, KY.—At the election held Nov. 3 the proposal to issue $5,000 in bonds for a municipal electric-light plant was defeated.

WARSAW, KY.—Local capitalists, it is reported, are planning to organize a company to construct and operate an electric-light plant in Warsaw.

NORTH JUDSON, IND.—Within the next 30 days the North Judson El. Co. expects to erect 12 miles of transmission line. Transformers, lightning arresters, etc., for same have been purchased. F. D. Pixa is manager.

ROANN, IND.—The Roann Lt. & Pwr. Co., recently incorporated, is planning to install an electric light and power plant to furnish electricity in Roann and surrounding territory. The proposed work will include the erection of 11 miles of transmission line, about 475 25-ft., 30-ft., 35-ft. and 40-ft. (6-in.-top) poles, possibly 100 meters and 25 incandescent street lamps. Transformers and other equipment have not yet been decided upon. R. F. Schuler is secretary.

SOUTH BEND, IND.—The Indiana & Michigan El. Co., of South Bend, is installing an underground system in South Bend, at a cost of about $100,000. F. A. Bryan is president.

CHICAGO, ILL.—The Illinois Public Utilities Commission has granted a license to the Chicago Automobile Transportation Co., which proposes to establish a motor bus line. The company expects to operate 150 cars.

FOX LAKE, WIS.—A proposal has been submitted to the Village Board by D. C. West, president of the Beaver Dam Lt. & Pwr. Co., of Beaver Dam, to furnish electricity in Fox Lake.

MADISON, WIS.—Bids will be received by Lew F. Porter, secretary of the Capitol Commission of Wisconsin, Madison, until Dec. 15, for furnishing labor and material for the interior finish of the north wing and the northeast and northwest corner pavilions of the Wisconsin State Capitol now building at Madison. Separate proposals will be received on each of the different branches of the work as follows: Mason work, carpentry work, stone and marble work, plumbing, electrical work, heating and ventilating, ironwork, leaded-glass work and elevators. Plans and specifications may be seen at the office of George B. Post & Sons, architects, 101 Park Avenue, New York, N. Y.; office of the Capitol Commission, Capitol, Madison, and the Builders & Traders' Exchange, Milwaukee, Wis. Plans may also be obtained upon deposit of $100, which will be refunded upon return of same.

BLUE EARTH, MINN.—The electric-light commissioners expect to install about 40 more ornamental standards carrying five-lamp clusters about May 1, 1915. D. Fitch is superintendent.

DODGE CENTER, MINN.—The Iowa & Minnesota Lt. & Pwr. Co. is installing an electric-light plant in Dodge Center. The equipment will consist of a 65-hp Munzel gas producer, one 60-kva, three-phase, 60-cycle, 2400-volt generator and switchboard, Duncan transformers (a Hayfield substation, outdoor type, will be installed in the spring), 300 poles (30 ft. 6 in.), three-conductor cable for the business section; Duncan meters and Packard incandescent lamps will be used. Homer T. Hall, of Dodge Center, is engineer in charge.

LYLE, MINN.—Within the next six months the village of Lyle expects to purchase one single-phase, 133-cycle dynamo, switchboard and oil engine (second-hand); also within the next 30 days to purchase transformers, meters, lamps and washing machines. N. T. Fortun is manager.

PRINCETON, MINN.—The Water and Light Commission expects to purchase electrical appliances and supplies, including vacuum cleaners, washing machines, etc., as needed. O. B. Randall is manager.

WINTON, MINN.—The installation of a new lighting plant in Winton is reported to be under consideration.

ALTA, IA.—Within the next three months the town of Alta expects to purchase poles, wire, etc., for rebuilding part of the municipal electric distributing system. B. Gurney is city electrician.

NORTH LIBERTY, IA.—Steps have been taken to organize a company to be known as the North Liberty Lt. Co. to supply electricity for lamps and motors in North Liberty. The company will be capitalized at $3,000. A. L. Moreland is interested in the project.

PATON, IA.—The contract for the installation of a complete transmission line, substation and distribution system for the town of Paton (bids for which were opened Sept. 22) has been awarded to the Standard El. Construction Co. of Waterloo.

ELDORADO SPRINGS, MO.—Within the next six months the Missouri Valley Lt. & Pwr. Co., of Eldorado Springs, expects to purchase a small (about 30 kw) 2300-volt steam-driven generating unit, to be operated in parallel with a Corliss engine. D. E. Bent is manager.

HALE, MO.—The Citizens' Lt., Wtr. & Pwr. Co., of Hale, expects to erect within the next six months a power house and install two boilers, 60 ft. by 16 ft., and one Corliss engine. Fred Halbauer is president.

KANSAS CITY, MO.—A movement has been started by property owners to replace the temporary lamps with permanent brackets on the viaduct extending from Twentieth Street to Twenty-fourth Street on Grand Avenue.

NEW HAVEN, MO.—Bonds to the amount of $10,000 have been voted for the construction of a municipal electric-light plant and improvements to water-works system.

KEARNEY, NEB.—The State Railway Commission has authorized the Kearney Wtr. & El. Co. to issue $35,000 in bonds, of which the proceeds of $15,000 will be used to pay outstanding indebtedness and the remainder for additional equipment for power plant.

LINCOLN, NEB.—The Lincoln Trac. Co. has recently erected a 2300-volt transmission line to the village of Bethany to supply electricity in that village. O. J. Shaw is assistant secretary.

LINDSAY, NEB.—The El. Lt. & Pwr. Co., of Lindsay, is contemplating installing a storage-battery system or changing its plant from direct to alternating current. As yet nothing definite has been decided upon. The company also expects to sell some electrical devices during the coming year. F. W. Edwards is manager.

NELIGH, NEB.—The Neligh Mills, recently awarded the contract for lighting the streets of the village, has purchased material for same. The contract calls for nine 100-cp nitrogen lamps and 50 nitrogen lamps of 60 cp. J. W. Spirk is manager.

NORTH BEND, NEB.—Contract for the installation of the proposed municipal electric-light plant will be awarded in about 30 days. C. A. Norgran, care Fairbanks, Morse & Co., Omaha, Neb., is engineer.

DODGE CITY, KAN.—Within the next three months the Midland Wtr., Lt. & Gas Co., of Dodge City, expects to purchase a generating unit and switchboard. The company is rebuilding its 2300-volt lines and rearranging them. All commercial and street-lighting wires in the business district are being placed underground. It has also just completed the erection of a transmission line to St. Mary's Academy, of Plains, 2 miles distant. Otto Theis is treasurer and manager.

PERRY, KAN.—Within the next ten months Charles Burgess, of Perry, expects to purchase a 50-kw generator, switchboard, waterwheel governor, meters, etc., for a city in Indiana.

Southern States

KINSTON, N. C.—The city of Kinston is contemplating the installation of a 300-kw steam-driven generating unit with condensing outfit in the municipal electric-light plant. Gilbert C. White, of Charlotte, is engineer.

THOMASVILLE, GA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 15 for the construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office at Thomasville. Drawings and specifications may be obtained at the above office or from the custodian of site at Thomasville. O. Wenderoth is supervising architect.

UNADILLA, GA.—The Council is contemplating the installation of an electric-lighting plant in connection with the pumping station later on. W. T. Van Laudingham is superintendent.

MARIANNA, FLA.—At an election held recently bonds to the amount of $35,000 were voted for extensions and improvements to the municipal electric-light plant and water-works system.

CHATTANOOGA, TENN.—The Tennessee Pwr. Co., of Chattanooga, it is reported, is planning to exercise its option on nearly 20,000 acres of land lying along the Toccoa River for 25 miles in Fannin County, Georgia. The lands would be overflowed by the construction of the proposed fourth and fifth dams of the Ocoee River, of which the Toccoa is a tributary. The tie-lines connecting the hydroelectric plant on the Ocoee River (so named where the Toccoa River enters the Tennessee), the Hale's Bar plant on the Tennessee River and the steam genrating plant at Nashville, Tenn., have been completed.

DRESDEN, TENN.—The Council has engaged Philip Porter, of Clinton, to make plans for the proposed municipal electric-light and water-works system. An election will be held Nov. 21 to vote on the proposal to issue bonds for the plant.

FRANKLIN, TENN.—The Franklin El. Lt. & Ice Co., it is reported, contemplates extending its transmission lines to Portland, a distance of about 12 miles.

CRYSTAL SPRINGS, MISS.—H. Converse, lessee of the municipal electric-light plant, expects to purchase within the next six months two crude-oil-engine-driven

generating units (one 12½ kw and the other 75-kw, 125 volts, direct current, directly connected).

LAUREL, MISS.—The Laurel Lt. & Ry. Co. is now installing an 800-kva Allis-Chalmers turbo-generator set, with condenser, etc., and a 300-kw rotary converter for street-railway service. The company has purchased three additional street cars.

GRAVETTE, ARK.—Within the next few months the village of Gravette expects to erect a new power house and to purchase boilers, generators, engines, wire and meters, and wiring supplies. E. H. Crayton is superintendent.

SPRINGDALE, ARK.—The local electric-light plant, owned by M. C. & G. E. Martin, has been purchased by Todd Brothers, who took possession of the property Nov. 1.

ALEXANDRIA, LA.—The city of Alexandria expects to purchase on Dec. 7 a condenser, two fire pumps, one service pump and one vertical centrifugal pump for the municipal electric-light plant and water-works system. J. C. Raxsdale is superintendent.

MELVILLE, LA.—The city of Melville has awarded the contract for the construction of the proposed municipal electric-light plant to C. A. Rees, of Shreveport, for $13,000.

NEW ORLEANS, LA.—Bids will be received by the board of commissioners of the port of New Orleans, Suite 200, New Orleans Court Building, New Orleans, until Dec. 14, for construction of compress No. 1, sorting sheds Nos. 1 and 2, power house, garage, office, warehouses J, K, G and H and their appurtenances, to be situated on the east bank of the Mississippi River, between Napoleon Avenue and Soniat Street, in New Orleans. Plans and specifications are on file in the office of Ford, Bacon & Davis, engineers, 921 Canal Street, New Orleans. Copies of specifications may be obtained of the engineers upon deposit of $100, which will be refunded upon return of same.

PRYOR, OKLA.—The Pryor Lt. & Ice Co. has been reorganized under the name of the City Lt. & Ice Co. The officers of the company are: W. A. Cullane, La Salle Building, St. Louis, Mo., president; W. J. O'Brien, of Durant, vice-president, and C. C. Kissel, secretary.

YALE, OKLA.—The city of Yale is sinking test wells for the purpose of finding a satisfactory water supply. As soon as the water is reached it is proposed to submit the proposal to issue bonds for water extensions and also for electric lamps to the voters. Benjamin Boon, of Hominy, is engineer.

BRYAN, TEX.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Dec. 18 for construction complete, including mechanical equipment, lighting fixtures and approaches, of the United States post office at Bryan. Drawings and specifications may be obtained at the above office or from the custodian of site at Bryan. O. Wenderoth is supervising architect.

COMMERCE, TEX.—The bond issue of $4,500 for the proposed municipal electric-light plant has been approved by the State Department.

CORPUS CHRISTI, TEX.—The Commissioners' Court of Nueces County has granted the Texas Southern El. Co., of Victoria, a franchise to construct and operate an electric interurban railway between Corpus Christi and Bishop, a distance of 35 miles. During the past few months the company has purchased several electric-light and power plants in different towns in South Texas.

ORANGE, TEX.—The properties of the Orange Ice, Lt. & Wtr. Co. are reported to have been purchased by W. H. Stark. The new owner, it is understood, will enlarge and make improvements to the electric-light and power plant.

SAN ANTONIO, TEX.—The National Masonic Sanitarium Association, it is understood, will build a power house in connection with other buildings. The building will be of fireproof construction and provide space for generating room, pumping room, boiler room, machine shop, incinerators, laundry, etc. Reuter & Harrington, Frost Building, San Antonio, are architects and engineers. C. A. Soule, 317 State Bank & Trust Building, is president.

SEGUIN, TEX.—Improvements are contemplated to the municipal electric-light and water plants, for which bonds to the amount of $20,000 have been voted.

SHERMAN, TEX.—Plans have been prepared by H. L. McDuffie, superintendent of the municipal electric-light plant, for extensions to the street-lighting system in the business district and residential section of the city.

Pacific States

SPOKANE, WASH.—The City Council is considering the installation of an ornamental lighting system on Sprague Avenue, from Division Street to Cedar Street, and on Trent Avenue, from Division Street to Lincoln Street, to cost about $110,000.

LAKEPORT, CAL.—The Mount Konocti Lt. & Pwr. Co., of Lakeport, expects to purchase within the next few months a small quantity of material for distribution and lighting system, including transformers, poles, distribution cable and wire, meters, incandescent lamps, and also some electrical appliances, including heating and cooking apparatus, etc. A. C. Hastings is vice-president.

SAN BERNARDINO, CAL.—The Southern Sierras Pwr. Co., of San Bernardino, has applied to the State Railroad Commission for permission to issue $300,000 in bonds, the proceeds to be used for retiring outstanding notes and for extensions and improvements to its system.

OGDEN, UTAH.—The Grand Canyon Canal & Pwr. Co., Ogden, recently incorporated with a capital stock of $200,000, contemplates the construction of a hydro-electric power plant on John Day's River, about 55 miles from Soda Springs, Idaho. The company has taken over the power sites held by Alexander Toponce, of Ogden, the consideration being $65,000. The officers are: Sidney Badcon, of Ogden, president; C. L. Gosling, vice-president; Arthur Kuhn, secretary, and Ralph Hoag, treasurer.

NOGALES, ARIZ.—Preparations are being made by the International Gas Co., of Nogales, for the installation of a new electric-light plant and ice factory for which contracts will soon be awarded. The equipment of the proposed plant will include two 300-kva, three-phase, 60-cycle, 2300-volt generators driven by oil engines of the Diesel type (directly connected), switchboard equipment, transformers, etc.; 30 miles of wire will be required for the overhead distributing system and red-cedar poles will be used. The ice-making and refrigerating equipment will include a motor-driven compressor of 40 tons refrigerating capacity, with complete ice-making and insulated cold-storage rooms. Later a new gas holder will be purchased for the existing gas plant. Ives & Davidson, 84 William Street, New York, N. Y., are engineers in charge of the work and will also supervise the operation of the plant after the new construction work is completed.

GARDINER, MONT.—The Gardiner El. Lt. & Wtr. Co. expects to purchase within the next 12 months one 6½-in. by 8-in. triplex double-acting pump. Albert Collins is engineer of power station.

POLSON, MONT.—Preliminary steps have been taken by the City Commission toward establishing a lighting district in Polson and installing a municipal electric-light plant.

BUENA VISTA, COL.—In accordance with the terms of a ten-year street-lighting contract signed last July the Buena Vista El. Lt. & Pwr. Co. has completed the installation of several additional lamps and has replaced the former inclosed-arc lamps with tungsten lamps using 400-watt units. W. P. Eyre is manager.

ALAMOGORDO, N. M.—The Alamogordo Lt. & Pwr. Co. has awarded a contract to the Fulton Iron Works Co., of St. Louis, Mo., for furnishing and installing one 150-hp (sea-level rating), Fulton Tosi Diesel oil engine, one 80-kva, three-phase, 2300-volt generator (directly connected to engine), with exciter and switchboard complete. William R. Eidson is general manager.

Canada

EDMONTON, ALTA.—Plans have been prepared, it is reported, by the Edmonton, Dunvegan & British Columbia Ry. Co. for the construction of power houses at St. Albert's Trail, to cost about $8,000.

KAMLOOPS, B. C.—At a special election to be held in the near future the proposal to issue bonds to the amount of $50,000 will be submitted to the ratepayers. If the bonds are voted, the proceeds of $40,000 will be used for extensions to the lighting service.

TRANSCONA, MAN.—The contract for furnishing and installing pumping machinery, including electrical equipment, has been awarded by the City Council to the Dominion Equip. & Sup. Co., of Winnipeg, at $14,255.

FLESHERTON, ONT.—The ratepayers, on Oct. 29, approved the by-law authorizing an appropriation of $5,500 for the installation of hydroelectric power in Flesherton.

NEWMARKET, ONT.—The Town Council has requested the Provincial Hydro-Electric Commission to submit estimates of the cost for furnishing electricity in Newmarket for street-lighting and domestc purposes.

OTTAWA, ONT.—Tenders will be received by the Board of Control, City Hall, Ottawa, until Nov. 26 for furnishing an electrically driven low-lift turbine pump and motor, also an electrically driven high-lift turbine pump and motor (both directly connected). Specifications and full information may be obtained at the office of the city engineer.

ST. CATHARINES, ONT.—Plans are maturing for a 250,000-hp development on Sixteen-mile Creek. It is proposed to erect a power house on the bank of Sixteen-mile Creek, using the water from Chippewa Creek, by means of an artificial channel 6 miles in length. The project was promoted by E. A. Pew over fifteen years ago, but was abandoned because the Cataract Pwr. Co. was the first to start operations at Decew Falls and the future extent of the power market was unknown.

TORONTO, ONT.—Tenders will be received by the chairman of the Toronto Electric Commissioners, Toronto, until Nov. 26 for synchronous converters with transformers and switchboard panels. Specifications and form of tender may be obtained at the office of the purchasing agent.

WELLAND, ONT.—The electric-light committee, it is reported, has decided to erect ornamental lamp standards at the north and south ends of the city, tenders for which will be called in the near future. The cost of the work is estimated at about $11,000.

QUEBEC, QUE.—Plans are being considered by the Quebec Ry., Lt. & Pwr. Co. for the development of additional power. The company has recently closed or is now negotiating power contracts aggregating 8000 hp, which include 2000 hp for the St. Malo shops of the National Transcontinental Railway and 3000 hp for the government dry dock at St. Levis. The company has recently closed a contract with the Ross rifle factory for an additional 6000 hp.

Mexico

GUADALAJARA, MEX.—Application has been made to the federal government by Chares P. Martin for a concession for the use of the water falls of Juanacatlan on the Santiago River, near Guadalajara. Mr. Martin contemplates the construction of a hydroelectric power plant and a system of transmission lines.

New Incorporations

ANDALUSA, ALA.—The Andalusa Lt. & Pwr. Co. has been incorporated with a capital stock of $15,000 by J. D. Henderson and others.

WILMINGTON, DEL.—The Pennsylvania Pub. Ser. Corpn. has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $500,000. The company proposes to operate electric-lighting plants. The incorporators are M. C. Miller, C. W. Hyde, of Harrisburg, and H. W. Davis, of Wilmington, Del.

OGDEN, UTAH.—The Grand Canyon Canal & Pwr. Co., of Ogden, has filed articles of incorporation under the laws of the State of Idaho with a capital stock of $200,000, for the purpose of constructing a hydroelectric power plant on John Day's River, about 55 miles from Soda Springs. The officers are: Sidney Badcon, of Ogden, Utah, president; C. L. Gosling, vice-president; Arthur Kuhn, secretary, and Ralph Hoag, treasurer.

MARKSVILLE, LA.—The Marksville Lt. & Ice Co. has been chartered with a capital stock of $10,000 by E. M. Kursheedt, James R. Black and R. P. Strong.

ELYRIA, OHIO.—The Lorain County El. Co. has been incorporated by E. E. Berger, R. A. Brooks, J. B. Johnson, and others. The company is capitalized at $10,000, and proposes to take over the properties of the Citizens' Gas & El. Co. and the Ely Lt. & Pwr. Co., which have been operated under the name of R. E. Berger, agent, since they were purchased by the Milligan company.

FULTON, TENN.—The South Fulton Lt. & Pwr. Co. has been incorporated by W. C. Morehead, D. H. Skeen, Herbert Carr, and others. The company is capitalized at $2,000.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED NOV. 10, 1914.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,116,402. Conductor-Wire-Reeling Mechanism for Telephones; C. W. Ferguson, Bower, W. Va. App. filed Feb. 18, 1913. For storing the terminal wires within the base of a desk telephone.

1,116,407. Range and Deflection Transmitter; E. Friedrick, United States Navy. App. filed Sept. 3, 1913. For communicating data from gunfire control station to the plotting room and from plotting room to sight setters.

1,116,424. Induction Motor; R. E. Hellmund, Pittsburgh, Pa. App. filed Aug. 2, 1909. Secondary winding for non-synchronous motor.

1,116,430. System of Electrical Distribution; R. P. Jackson, Wilkinsburg, Pa. App. filed Dec. 6, 1907. Circuit-closers do not open under abnormal conditions for which they are not adapted.

1,116,432. Regulator for Electric Circuits; H. D. James, Pittsburgh, Pa. App. filed Feb. 3, 1910. Induction regulator with continuously running motor for adjusting the windings.

1,116,433. Controller for Induction Motors; H. D. James, Pittsburgh, Pa. App. filed Sept. 19, 1910. For manually removing resistance from secondary and automatically reinserting same upon interruption of primary circuit.

1,116,442. Electric Toaster and Broiler; H. F. Kirkwood, Kineo, Me. App. filed June 7, 1913. Oscillating carrier positions the food between the heating elements.

1,116,447. Electrical System; C. D. Lanning, Boston, Mass. App. filed Dec. 30, 1905. Telephone repeater system.

1,116,450. Manufacture of Metallic Filaments for Electric Lamps; A. Lederer, Vienna, Austria-Hungary. App. filed Nov. 11, 1910. Heats tungsten filament in an atmosphere of pure dry hydrogen.

1,116,453. Synchronizing Apparatus; S. Lubin, Philadelphia, Pa. App. filed March 5, 1909. Orally signals the operator when the speed of the kinetoscope is out of time with the phonograph.

1,116,455. Electrical Measuring Instrument; P. MacGahan, Pittsburgh, Pa. App. filed July 17, 1912. Special mounting for the pointer.

1,116,458. Fire-Alarm System; M. Matos, Lorain, Ohio. App. filed Feb. 11, 1914. Circuit-closer is explosively operated.

1,116,472. Alternating-Current Electric Meter; C. North, Stretford, England. App. filed June 21, 1911. Induction type; of light and simple construction.

1,116,475. Circuit-Breaker; T. S. Perkins, Wilkinsburg, Pa. App. filed June 12, 1905. Overload; for electric railway cars.

1,116,477. Safety Device for Electric Circuits; O. Peterson, DeKalb, Ill., and H. C. Smith, Geneva, Ill. App. filed May 16, 1914. For protecting house-lighting systems from higher potential circuits.

1,116,480. Electric-Vapor Arc Lamp; E. Podszus, Berlin, Germany. App. filed Oct. 4, 1909. Vaporized electrode is conducted through a solid tube of refractory material, which is caused to glow by the heat of the arc.

1,116,492. Brush-Holder; A. N. Sammarone, Akron, Ohio. App. filed Jan. 31, 1914. Stamped sheet-metal holder for carbon brushes.

1,116,504. Motor Controller; A. Simon, Milwaukee, Wis. App. filed Jan. 11, 1909. For alternating-current motors; controlling switch and transformer, both arranged in same case and immersed in oil.

1,116,522. Device for Suspending Trolley Wires, Etc.; W. H. Watts, Hamilton, Va. App. filed Nov. 18, 1913. Construction of hinged clamp.

1,116,537. Signal Receiver; C. A. Bals, Chicago, Ill. App. filed April 24, 1911. Two-gong bell with two coils controlled by the armature.

1,116,538. Telephone-Exchange System; M. L. Johnson, Chicago, Ill. App. filed July 15, 1912. Has a plurality of operator's positions.

1,116,539. Telephone-Exchange System; M. L. Johnson, Chicago, Ill. App. filed July 15, 1912. Numbers of the desired lines are automatically repeated back to the calling parties.

1,116,540. Telephone-Exchange System; M. L. Johnson, Chicago, Ill. App. filed Aug. 10, 1912. Operators for receiving calls and other operators for extending calling lines.

1,116,541. Telephone-Exchange System; M. L. Johnson, Chicago, Ill. App. filed Aug. 10, 1912. Recording and reproducing apparatus conveys the information in recorded form from the first operator to the second operator.

1,116,542. Telephony; M. L. Johnson, Chicago, Ill. App. filed Dec. 4, 1912. Plurality of signal-sending lines.

1,116,552. Motor-Starting Switch; C. H. Bissell, Syracuse, N. Y. App. filed May 21, 1913. Special means controlling the operation of the shiftable switch member.

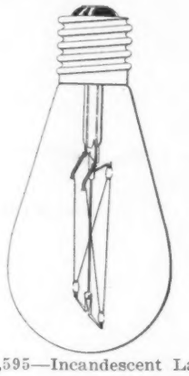
1,116,561. Switch-Plug Lock; H. Butz, Albion, Ind. App. filed April 3, 1913. Permutation-lock ignition switch.

1,116,566. Electric Switch; R. H. Conrad, Oakland, Cal. App. filed Feb. 2, 1914. Automatic starting, overload and no-voltage-release switch.

1,116,586. Electric Sadiron; W. S. Hadaway, Jr., East Orange, N. J. App. filed May 13, 1909. Body of metal poured about metal-clad resistance element.

1,116,588. Receiver for Wireless Communication; W. Harrison, Brooklyn, N. Y. App. filed Feb. 8, 1904. Wires of antenna bent sinuously into loops.

1,116,591. Telegraph Repeating System; A. T. Jester, Houston, Tex. App. filed May 12, 1913. Improved repeater adapted to repeat both ways.



1,116,595—Incandescent Lamp

1,116,595. Incandescent Lamp; A. S. Knight, Newark, N. J. App. filed Nov. 3, 1909. W-shaped filament symmetrically arranged in respect to the supporting arbor.

1,116,598. Annunciator; O. M. Leich, Genoa, Ill. App. filed March 4, 1912. Combined drop and jack.

1,116,606. Electrical Apparatus for Effecting the Chemical Combination of Gases; C. C. Meigs, Charleston, S. C. App. filed Jan. 23, 1914. Electrical sparks produced within spaces between the cooling rings.

1,116,607. Protective Device for Electrical Circuits; G. Moore, Frankfort, Ind. App. filed Oct. 16, 1913. Particularly for telephone circuits.

1,116,631. Insulator; F. J. Schisler, Winthrop, Minn. App. filed March 24, 1913. Reinforced glass with slot in which the conductor rests loosely.

1,116,652. Trolley Head; C. W. Warner, Vancouver, British Columbia, Canada. App. filed Feb. 26, 1914. Carries vertical guide rolls engaging guide wires at the opposite sides of the trolley head.

1,116,657. Printing Telegraph; C. J. Wiley, Yorktown, N. Y. App. filed June 16, 1913. Independent mechanisms for printing quotations of the lesser and the more active stocks.

1,116,661. Treatment of Gases; E. R. Wolcott, Chicago, Ill. App. filed Aug. 14, 1909. Combining nitrogen and oxygen of air to form nitric acid.

1,116,667. Telephone Cutout; J. Anderson, Jr., Omaha, Neb. App. filed Oct. 7, 1912. Push-button on the post of the instrument for breaking the transmitter circuit.

1,116,705. Electromotor; B. F. Hutches, Jr., Allendale, N. J. App. filed May 3, 1910. Novel construction and mounting of parts; low power motor.

1,116,763. System of Automatic Block Signaling; F. Townsend, New York, N. Y. App. filed Jan. 26, 1906. Special track circuits.

1,116,772. Apparatus for Treating Metals; S. T. Wellman, Cleveland, Ohio. App. filed Aug. 18, 1911. Reducing and melting steps accomplished in separate electric furnaces, a movable bottom containing the charge being shifted from one to the other.

1,116,818. Storage Battery; F. M. Holmes, Springfield, Mass. App. filed Aug. 12, 1912. Can be charged at a very high rate.

1,116,855. Electric Heater; E. A. Sperry, Brooklyn, N. Y. App. filed Jan. 4, 1908. Steam generator, with heating units contained within a heating fluid circulating within the flues of the boiler.

1,116,865. Process of Producing Alkali and Alkaline-Earth Metals; C. E. Acker, Ossining, N. Y. App. filed Aug. 5, 1910. Produces sodium by electrolyzing a fused cyanogen compound of sodium.

1,116,870. Controlling from a Distant Point the Operation of a Mechanism or Instrument; C. Berger, Budapest, Austria-Hungary. App. filed March 19, 1910. Electric acoustic mechanism for operating toys, etc.

1,116,871. Method and Means for Reducing Sparking in Electrical Apparatus; D. M. Bliss, West Orange, N. J. App. filed Aug. 30, 1911. Sprays a vaporizable liquid upon the commutator segments.

1,116,883. Electric System for Automobiles; E. A. Halbleib, Rochester, N. Y. App. filed Oct. 9, 1911. Three-wire system with differentially wound dynamotor.

1,116,884. Electric Furnace; W. H. Hampton, New York, N. Y. App. filed Feb. 17, 1913. For reduction of iron ore.

1,116,893. Safety Device for Secondary Cells; M. R. Hutchinson, West Orange, N. J. App. filed June 21, 1911. Combined separator, electrolyte replenisher and flame extinguisher.

1,116,902. Switch; J. M. Lorenz, Chicago, Ill. App. filed March 9, 1914. Ratchet button for attachment to ordinary rotary snap switch.

1,116,951. Process of Electrical Separation; H. M. Sutton and W. L. and E. G. Steele, Dallas, Tax. App. filed Sept. 24, 1904. Electrostatic system.

1,116,952. Starting Box; M. Taigman, New York, N. Y. App. filed May 8, 1914. Special resistance coil and other features.

1,116,960. Metallic Electrode; E. Weintraub, Lynn, Mass. App. filed April 5, 1912. Mercury-arc rectifier with anodes of drawn metallic tungsten.

1,117,006. Cup Post for Electric Batteries; J. A. Doran, Providence, R. I. App. filed July 3, 1913. Cup which frictionally engages over the end of the electrode has a connecting post drawn up out of the metal thereof.

1,117,031. Electric Lighting Fixture; J. F. Gilchrist and G. B. Keil, Chicago, Ill. App. filed March 2, 1914. Shade bracket and socket for adjustable connection with an electric sign.

1,117,039. Sterilizer; J. O. Halverson, Portland, Ore. App. filed June 23, 1913. Has a cover which, as it is lifted, raises the article-supporting tray.

1,117,042. Train Stopping and Signaling System; L. C. Hansen, Liberty, Saskatchewan, Canada. App. filed May 27, 1913. Special signaling and stopping mechanism.

1,117,046. Electric Switch; C. Hill, Geneva, Ohio. App. filed May 15, 1912. For use in a signal system.

1,117,084. Attachment for Conduit Outlet Boxes; J. C. Phelps, Springfield, Mass. App. filed April 11, 1912. Extension piece connecting with the neck of the outlet box.

1,117,128. Clarifying Transparent Media; C. E. Camm, Chicago, Ill. App. filed Feb. 11, 1913. Heater wire disposed between two transparent glass panes to keep them free of moisture, etc.

1,117,140. Portable Electrically Driven Tool; J. A. Osborn, St. Louis, Mo. App. filed Dec. 12, 1913. Drill or reamer.